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Leona Canyon
Regional Open Space Preserve
Land Use Plan



LEONA CANYON REGIONAL OPEN SPACE PRESERVE

LAND USE PLAN

May 1998

East Bay Regional Park District
Planning/Stewardship Department
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**Leona Canyon Open Space Preserve
Draft Land Use Plan**

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I. INTRODUCTION

Since the acquisition of Leona Canyon Open Space Preserve by the East Bay Regional Park District in 1986, the parkland has been operating as a regional preserve, offering recreational and educational opportunities for residents of the Oakland Hills and adjacent areas. The park, located approximately ½ mile from the junction of Interstate 580 and Highway 13 in the Oakland Hills, is situated to the south of Merritt College and Leona Heights Park (City of Oakland), and immediately north of the Oak Knoll Naval Hospital (Figures 1 and 2).

In the mid 1970s, the area encompassing Leona Canyon Open Space Preserve was originally planned for the development of nine homes, on 40-50 acre parcels. This development was included as a component of the 680-acre Caballo Hills housing development proposed for the Oakland Hills by Ridgemont Development Company. However, at the suggestion of a City Commissioner, the developers dedicated 271 acres, commonly known as Windy Gulch, to the East Bay Regional Park District which was later renamed Leona Heights Open Space Preserve. Additional acquisitions by the Park District have resulted in a total park acreage of 289 acres.

This Land Use Plan proposes a name change to reflect the geographical and natural features of the parkland, which is set in a deep canyon. Additionally, there is a City of Oakland park named Leona Heights Park located less than one mile to the northwest of the parkland. Due to the proximity of the two parks, and the similar names, confusion has arisen related to the provision of emergency and medical services, as well as confusion for park patrons. As a result of this Land Use Plan, the name of the parkland will be changed to Leona Canyon Open Space Preserve. This name change is reflected throughout the remainder of this document.

With the implementation of the Leona Canyon Open Space Preserve Land Use Plan, the majority of the parkland will remain in its natural condition, with the exception of the areas managed for fuel reduction and fire hazard prevention. Trail connections are proposed in two locations to provide regional access to public open spaces located within close proximity to the parkland. Trail names will be given to those trails not currently named in the District's Master Plan to reflect the botanical richness and uniqueness of this open space preserve.



Leona Canyon Regional Open Space Preserve

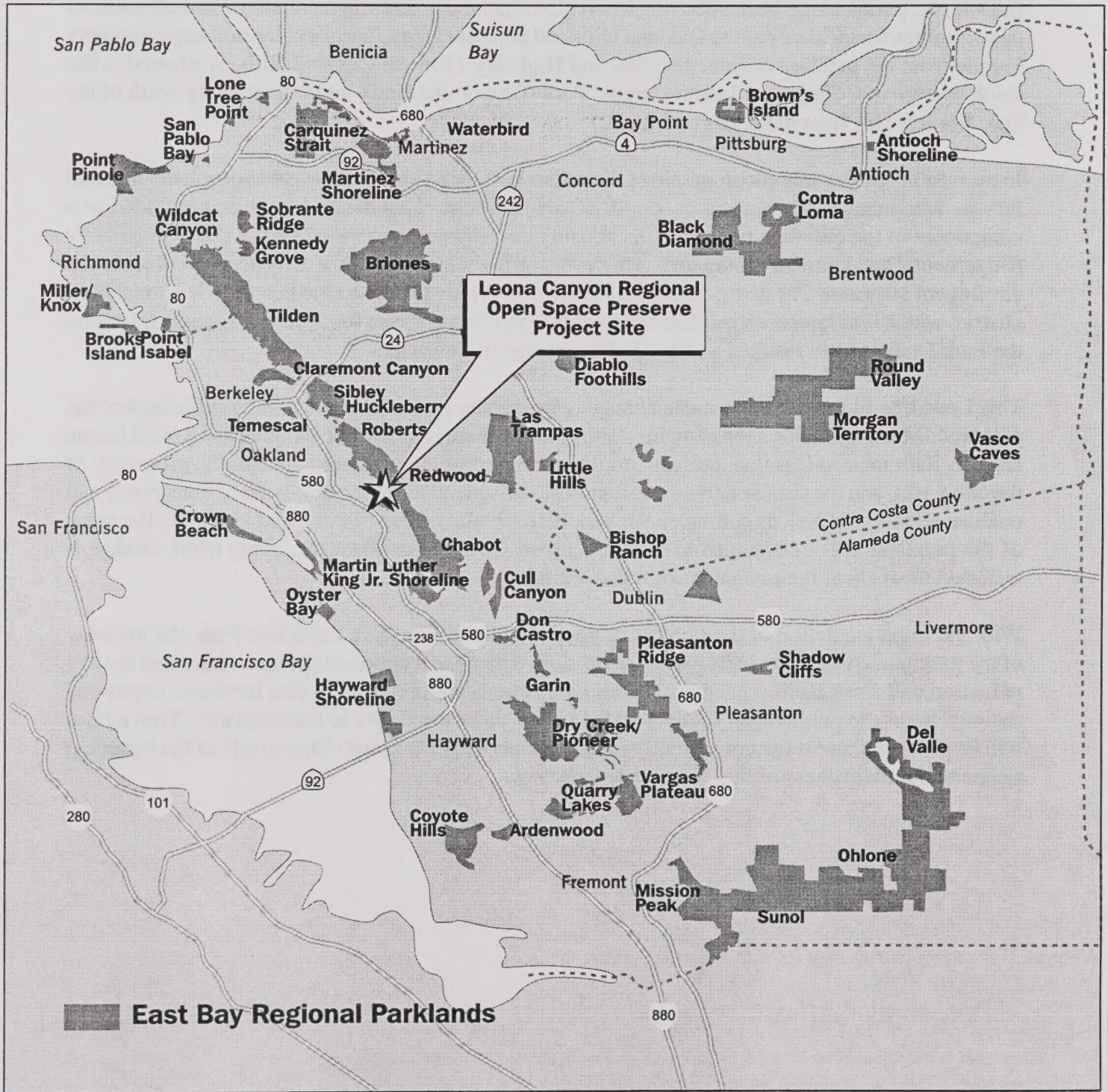
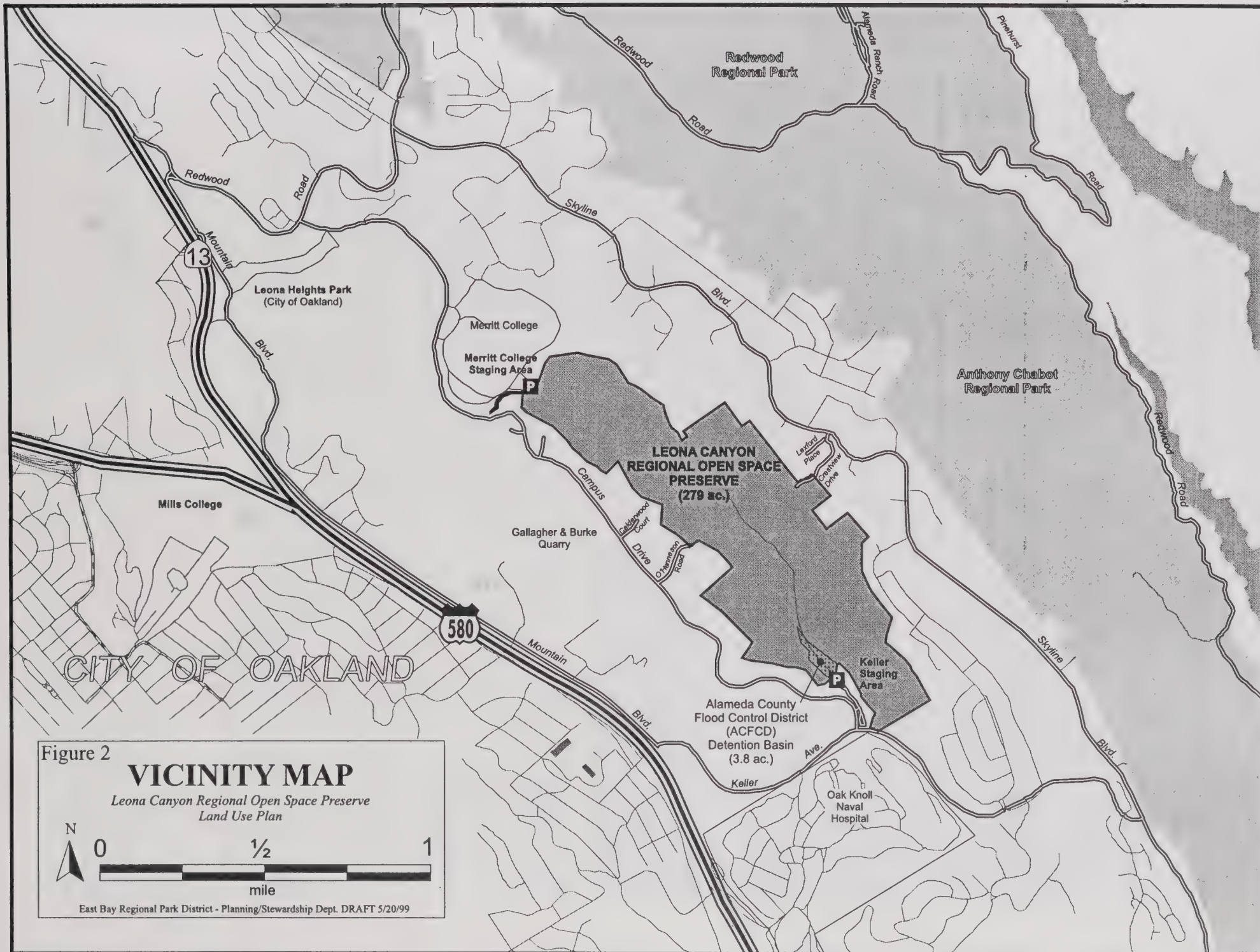


Figure 1
LOCATION MAP
Leona Canyon Open Space Preserve
Contra Costa County, California





II. PLAN SUMMARY

A. Project Setting

The parkland is generally bounded by residential development on the east and west, Merritt College on the north, and the Oak Knoll Naval Hospital on the south. The two ridges to the west and east of the parkland support residential development, consisting primarily of single-family homes. Large-lot residential development and fairly large areas of open space are located along the eastern ridge, while single-family homes with an average lot size of one acre ring the parkland on the western edge. Residential development on the western ridge includes a subdivision of 310 homes that was constructed in 1984 by the Ridgemont Development Company. Two quarries are located in the vicinity of Leona Canyon Open Space Preserve, including the Gallagher & Burk Quarry (active) and the Leona Heights Sulfur Mine and Mining Waste Disposal Site (closed). Leona Heights Park, a City of Oakland public park, is located approximately 3/4 mile northwest of the park, near the junction of Highway 13 and I-580.

Leona Canyon Open Space Preserve is comprised of two ridgelines separated by a canyon, with elevations ranging from approximately 400 feet in the canyon to 1175 feet on top of Sugarloaf Hill (Figure 3). The Rifle Range Branch of the Arroyo Viejo Creek enters the park from the northeast, and traverses the park along the base of the canyon, until it discharges into the detention basin located at the southern end of the park. Slopes on both sides of the canyon are steep and densely covered with vegetation. The parkland encompasses a variety of ecological habitats commonly found in the East Bay Hills. Vegetation communities range from oak/bay woodland along the east-facing slopes, to riparian vegetation along portions of the Rifle Range drainage, to grasslands and an intermixture of coastal shrub and chaparral along the east ridge and west facing slopes.

Developed features include two staging areas, a multi-use trail traversing the park north to south and two emergency vehicle maintenance access (E.V.M.A.) trails entering the park from the east and the west. The Alameda County Flood Control District (ACFCD) has developed a detention basin in the southern tip of the park, adjacent to the Ridgemont at Keller staging area. This area is maintained for flood control purposes by the ACFCD. Overflow from the detention basin travels through a culvert located at Keller Avenue and deposits water into the Rifle Range Branch that traverses the Oak Knoll Naval Hospital property, located on the southern side of Keller Avenue. There are remnants of houses, sheds and other small structures associated with the past grazing and ranching uses of the park and surrounding area within the park boundaries. A well is located off of the Leona Canyon Open Space Preserve main trail, and remnants of an old hunting lodge are located about midway through the park, adjacent to the main trail. The most recent acquisition, the McKell property, includes a log cabin, barn, corral, and associated outbuildings. A PG&E power line crosses the park from Hansom Drive, across the canyon, terminating at these structures. The entire property was grazed until the early 1970s.

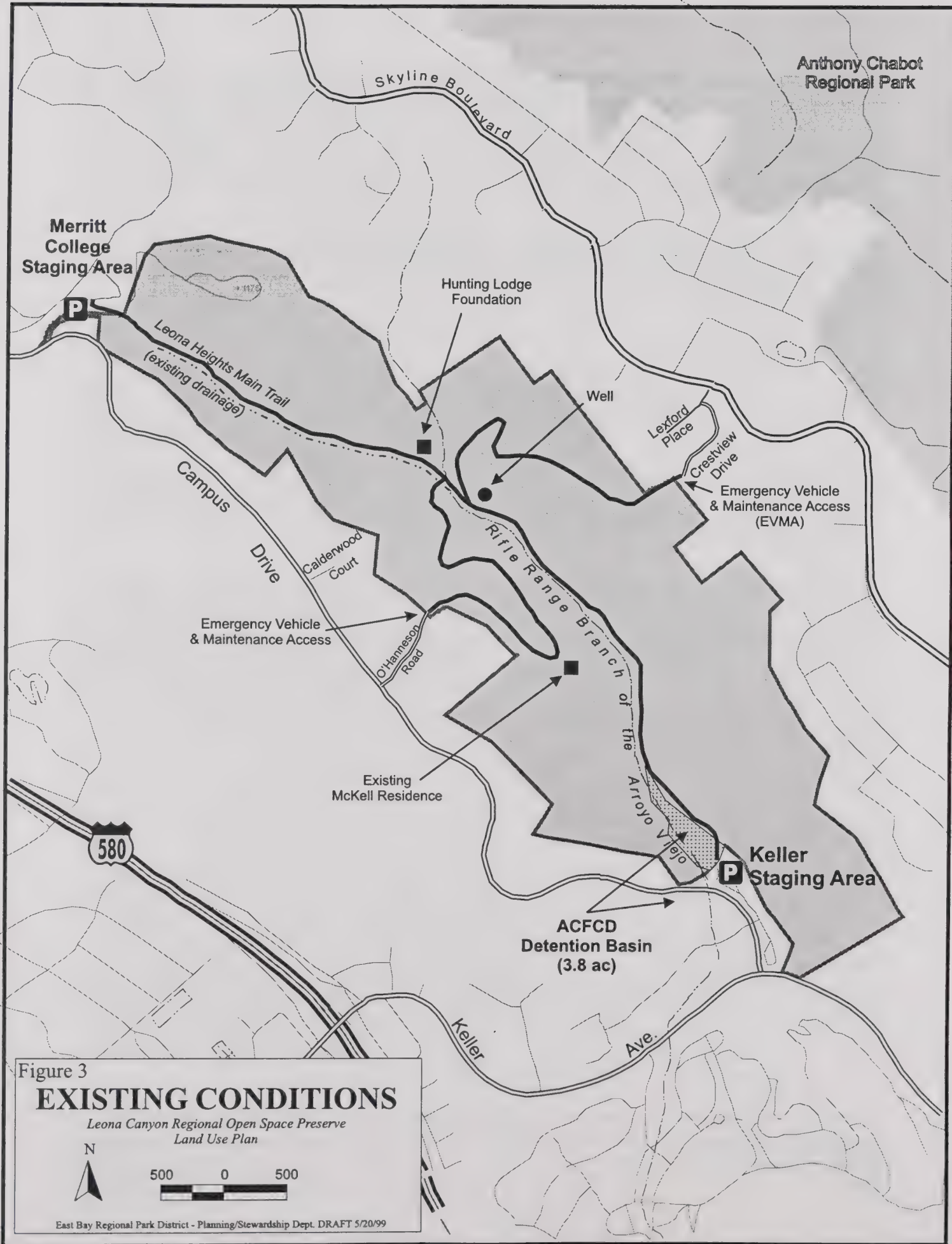
The parkland has been open and operating as an EBRPD park for approximately 12 years. The primary park users consist of neighbors and local residents who enter the park from the two walk-in gated access points off Skyline Boulevard and Campus Drive, or the two staging areas located off Keller Drive and within the Merritt College campus. The park provides hiking and walking opportunities as well as educational opportunities for students at Merritt College, Mills College, and other schools in the area.

Park supervision and maintenance activities are conducted by the staff of Anthony Chabot Regional Park. Normal maintenance activities include brush clearing, trail maintenance, trash removal, and patrol and surveillance.

B. Project Description

This Land Use Plan encourages the continued use of Leona Canyon Open Space Preserve as a regional preserve, to provide resource protection and passive recreational opportunities. The primary goal of the plan is to identify fire management and fuel reduction study zones and create a detailed plan for the management of these areas using fuel reduction methods routinely employed by the Park District. Resource management priorities and policies have been identified and included in this plan to provide guidance and strategies for the protection of natural resources and management of fire risk.

The secondary goal of the plan is to improve regional access opportunities and encourage public access and enjoyment of the park. Public access, trails and recreational facilities will remain primarily unimproved, with the exception of two proposed trail connections and potential future land acquisitions, including portions of the Gallagher & Burk property. In addition, access to the staging area at Merritt College will be improved through the creation of a pedestrian access off Campus Drive. Trail names will be identified and directional signs will be installed to encourage awareness and usage of the park.



C. Key Plan Recommendations

Fire Management

This plan recommends fire management and fuel reduction priorities for three fuel break zones identified within the parkland in high fire hazard areas. These zones are shown in Figure 7 and will be managed for different vegetation types, using traditional fuel modification and reduction techniques. The fuel breaks will be incorporated into the park District's application for a grant from the Federal Emergency Management Agency (FEMA) for assistance in vegetation management for fire safety in the East Bay Hills.

Resource Management

The plan identifies general vegetation management goals and policies for plant communities located outside of the fire hazard treatment zones which would enhance existing habitat, maintain plant and animal diversity and reduce the threat of fire. Habitat for four special-status wildlife and plant species is found within the parkland, including the Alameda whipsnake, Cooper's hawk, Oakland star tulip, and western leatherwood. Because no development is proposed within the parkland, the habitat for these four species would remain mostly unchanged. However, portions of the parkland will be managed for the Alameda whipsnake in conjunction with the management of shrubland and grassland communities for fire protection.

Trails

No changes are proposed to the existing trail system within the parkland. The existing multi-use trails are comprised of fire roads traversing the park, terminating at two major access points with staging areas and two neighborhood access points. The Land Use Plan proposes the addition of two trail connections providing access to the Oak Knoll Naval Hospital and Anthony Chabot Regional Park. In addition, an alternate access point will be provided to the staging area located within Merritt College to provide pedestrian access during times when the college campus is closed.

The Land Use Plan includes a proposal to change the name of the "Leona Heights Trail" to the "Arroyo Viejo Trail." The neighborhood access trail entering the parkland from the east would be named the "Pyrite Trail" and the neighborhood access trail entering the parkland from the west would be named the "Artemisia Trail." All name changes would reflect the natural and historical context of the parkland, nestled in a valley in the Oakland hills.

Public Access

The Land Use Plan recommends increasing public awareness and access opportunities through the installation of signs on local roadways to identify the locations of the staging areas and the local access points. Two future trail connections are also proposed which would provide access to the Oak Knoll Naval Hospital and Anthony Chabot Regional Park. Access to the Merritt College Staging Area would be improved through the creation of a pedestrian access off Campus Drive.

Site Security

Nighttime security at the Keller Staging Area will be enhanced through the installation of lighting fixtures at strategic areas within the parking lot.

III. EXISTING CONDITIONS

A. Planning Context

Regional History

Leona is the name of the community or district that developed near the present site of Chabot Observatory, which was economically centered on the Leona Heights Mine (rhyolite, pyrite and quarry rock), a commercial laundry (the site was also known as Laundry Farm), and the Leona Resort (Leona Heights Hotel). Leona rhyolite deposits, found between Claremont Canyon and the San Leandro border, were especially important to the City's early development.¹ For years, these volcanic rocks were mined in quarries and open pits in the East Bay, providing material for road bases, paving, curbs, and foundation stones.

During the 1880s a mine for the quarrying of paint manufacturing materials opened in the area above the Leona Heights City Park. By 1888, a railroad had been established to carry picnickers in and out of the area and to haul ore and quarry materials. Two years later, in 1890, a fine grain trap rock was discovered on the ridge that is now occupied by Merritt College. A quarry was developed (Leona Heights Mine) to extract this material, which was used in the production of macadam and concrete.²

The Leona Heights Hotel was constructed in 1890, as a resort and weekend getaway for residents of the Bay Area. The hotel and picnic grounds encompassed 200 acres of land, and probably stood at the foot of Redwood Road near the Leona Heights City Park. The train provided round-trip tickets for as little as 40 cents from San Francisco. The hotel was in operation until it burned down in 1906.³

In 1906, pyrite ore was discovered in the Leona rhyolite of the Leona Heights Mine. Pyrite is an iron sulphide that is used to produce sulphuric acid, and occurs in a fracture zone in the rhyolite. Rhyolite is the only rock in the County containing disseminated pyrite crystals. The mine was operated for 20 years by the Leona Chemical Company, until 1926, resulting in extractions valued at over one million dollars.

¹ "Open Space, Conservation and Recreation Plan" (OSCAR), City of Oakland, October 1995.

² Archaeological Consulting and Research Services, Inc., *Report of the Archaeological Reconnaissance of the Proposed Mountain Village Developments*, n.d.

³ Franklin, Harold J., *A Brief History of Leona Canyon*, n.d.

Parkland History

The original dedication to the Park District included over 400 acres of land, in two separate parcels including the Leona Sulfur Mine (104 acres). In 1986, the Park District authorized the dedication, accepting 271 acres of the original offer. The Park District declined to accept the entire 400 acres due to potential problems associated with acidic water runoff from the sulfur mine on the property, and indications of landsliding in some areas.

The land, commonly called "Windy Gulch" along with three easements for patrol and maintenance and an easement for public parking and public access in the southern end of the park, was dedicated to the District by the Ridgemont Development Company. The Park District deeded 3.8 acres of land at the southern end of the park to the Alameda County Flood Control District (ACFCD)(See Figure 3). The ACFCD maintains this area as a siltation basin to capture runoff that travels through the parkland from surrounding development.

Leona Canyon Open Space Preserve was designated a regional preserve by the EBRPD due to its outstanding natural features, including well developed oak/bay woodland along the east-facing slopes, and riparian vegetation in the canyon. Staging areas were located at the southern end of the Merritt College campus off Campus Drive and on the southern boundary of the parkland within the parking area of the Ridgemont at Keller condominiums off Keller Avenue. The staging area at Merritt College was established through a "Right of Entry Agreement" between the Park District and Peralta Community College District, which defines the uses and boundaries of the staging area. The Keller Staging Area is located on land owned and maintained by the Park District.

Trails were established along a combination of existing fire and city roads. Fire emergency access routes were established in late 1985 at two key areas along the eastern and western ridges. Maintenance of these access routes, both staging areas, and all trails within the park are the responsibility of the Park District.

In April 1992, the Park District acquired an eight-acre parcel located immediately adjacent to the northeastern park boundary. The existing structure was removed, and the land was incorporated into the park boundaries.

In November 1998, the Park District acquired the McKell parcel, located immediately adjacent to the parkland, along the western edge. This area, comprised of 10.31 acres of oak/bay woodland and shrubland, provides a valuable addition to the parkland. The house and associated structures located on this property were previously considered an inholding, because this area was only accessible via Park District roads.

Relevant Plans and Policies

The following plans were used in the preparation of this Land Use Plan:

1997 East Bay Regional Park District Master Plan. The Master Plan defines the vision and the mission of the East Bay Regional Park District and sets priorities for the next ten years for all of the existing parklands and future acquisitions. The Master Plan provides policies and guidelines for achieving the highest standards of service in resource conservation, management, interpretation, public access, and recreation. This Land Use Plan was prepared in conformance with the Planning and Management Guidelines outlined in the Master Plan and intends to provide a long-range plan for the Leona Canyon Open Space Preserve.

City of Oakland General Plan - Open Space, Conservation and Recreation, 1995. The Open Space, Conservation and Recreation Element (OSCAR) of the City of Oakland General Plan is the official policy document addressing the management of open land, natural resources, and parks within the City of Oakland. OSCAR includes several objectives, policies, and actions that identify planning priorities for Leona Canyon Open Space Preserve, including trail connections to adjacent lands. The recommendations of the plan are incorporated into the Leona Canyon Open Space Preserve Land Use Plan to the extent feasible. Any future land acquisitions and potential trail connections not addressed in this Land Use Plan may be pursued by the City of Oakland.

Fire Hazard Mitigation Program and Fuel Management Plan for the East Bay Hills, East Bay Hills Vegetation Management Consortium, May 1995. The Mitigation Program and Vegetation Management Plan were developed by the Vegetation Management Consortium (VMC) to identify management goals and priorities for reducing the risk of fire along the urban wildland intermix in the East Bay Hills. The VMC is comprised of representatives from the cities, special districts, state and federal agencies that manage public lands and regulate private lands in the East Bay hills. The Plan provides mitigation programs for the reduction of fire hazards on both public and private lands, including the designation of fuel modification zones, fuel breaks, greenbelts and fire trails. The EBRPD Board of Directors formally adopted the 1995 Plan in October 1996 (Board Resolution no. 1996-10-282). The recommendations resulting from this Plan have been incorporated into the fire management goals and responsibilities of this LUP, as outlined below in the Plan recommendations.

B. Natural Resources

This section summarizes the natural resources that exist within the parkland, with special emphasis on special-status plant and animal species. Special-status species include plant and wildlife species that are listed as rare, threatened, endangered (RTE), or are candidates for listing as RTE by state and federal resource agencies. These species have varying degrees of legal protection under the California and Federal Endangered Species Act and the California Environmental Quality Act (CEQA).

Monitoring animal and plant populations will continue as part of ongoing wildlife and vegetation management at the park.

Vegetation

The parkland supports a mosaic of open grassland, shrubland, and oak/bay woodland vegetation (Figure 4). The flora is a mixture of native trees and shrubs, and native and non-native annual and perennial herbaceous plants. The various natural plant community types that occur here are grouped into major categories of woodland, grassland, shrubland and riparian and wetland.

Natural plant communities within the parkland were mapped and verified in the field using aerial photographs. The vegetation map in Figure 4 documents the distribution of those plant communities within the open space. Natural plant communities were named according to Sawyer's and Keeler-Wolf's, A Manual of California Vegetation (1995), where applicable.

The California Native Plant Society Inventory of Rare and Endangered Vascular Plants of California, Fifth Edition (Skinner and Pavlik 1994), the California Natural Diversity Database (NDDB 1997), and the California Native Plant Society Electronic Inventory (1997) were reviewed to determine which rare and endangered plants had the potential to occur on the site. A summary of these plants are included in the appendix. The Oakland star-tulip (*Calochortus umbellatus*) and western leatherwood (*Dirca occidentalis*), California Native Plant Society (CNPS) designated rare plants, are found on the open space. Several plants considered to be "unusual and significant" also exist here. These include dogbane (*Apocynum androsaemi-folium*), water hemlock (*Cicuta douglasii*), and Oregon grape (*Berberis pinnata* var. *pinnata*).

Woodland

The parkland is situated in a steep, wooded canyon extending from southeast to northwest. Oak/bay woodland is the dominant plant community along the northeast-facing side and in the drainages on the southwest-facing side. Coast live oak and California bay laurel are the two dominant trees of this plant community. Associated tree species include California buckeye and California hazelnut. The understory vegetation of shrubs, herbs, ferns, and grasses is relatively diverse. Several native grass species, such as blue wild rye and melicgrass, occupy the woodland. The shrubs include poison oak, California blackberry, snowberry, gooseberry, coffeeberry, huckleberry, honeysuckle, wild rose, and

ocean spray. Several isolated patches of shrubland vegetation dominated by coyote brush and poison oak are scattered throughout the oak/bay woodland.

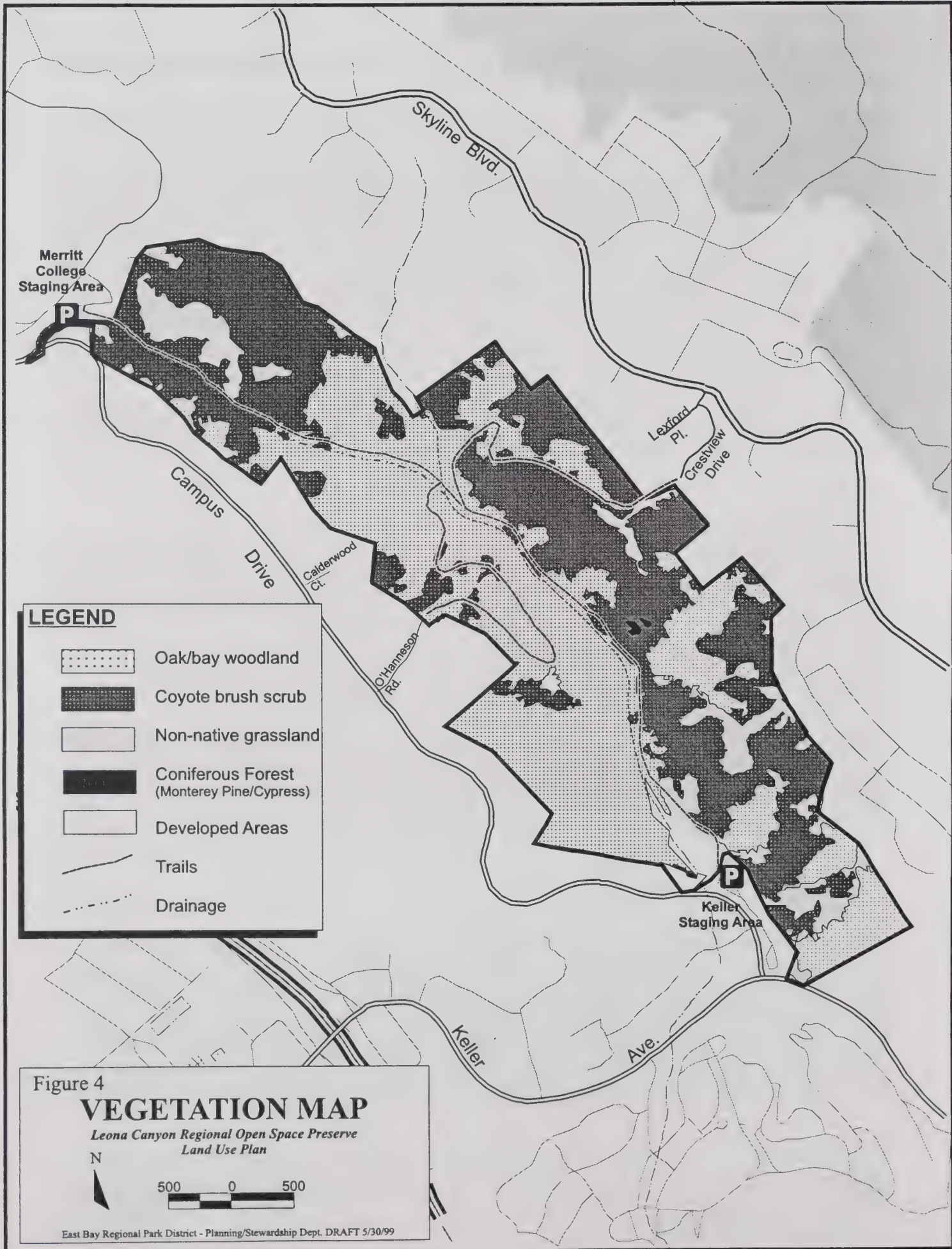
Grassland

A mosaic of California annual grassland and shrubland vegetation occupies the southwest-facing slopes. Shrubs are colonizing the open grassland in the absence of the periodic burning and/or grazing that occurred here historically and kept the shrubby vegetation in check. The grassland consists mostly of non-native annual grasses and herbs, along with native annual fescue grasses. Native perennial grasses are sparsely represented. The dominant plants are non-native, naturalized grasses, such as wild oats, soft chess, annual ryegrass, and/or ripgut brome. Other non-native grasses, like wild barley, red brome, silver hairgrass, and little quaking grass occur in lesser amounts. Native and non-native herbs are interspersed among the grasses. Some scattered stands of weedy, opportunistic plants, such as bull thistle, yellow starthistle, black mustard, and French broom occupy disturbed areas within and around the margins of the grassland/shrubland mosaic, particularly along the roads. In the absence of grazing or burning, a thatch-like layer of dead plant material has accumulated in the grasslands over the years.

Shrubland

A coyote brush/California sagebrush/poison oak shrub association occurs in virtually impenetrable thickets along the southwest-facing slopes of the canyon. The herbaceous plant understory is poorly developed, with extensive areas of bare ground and plant litter. This vegetation has become well established in many areas and continues to encroach into surrounding grasslands where no active land management (i.e. burning, grazing) has occurred for many years. Left to its own devices, a natural succession from shrubland to oak/bay woodland would occur over several centuries on certain sites, whereas shrubs would remain as the dominant growth form on other sites.

Periodic wildfire events or a prescribed burning program would serve to maintain the shrubland in earlier successional stages that support plants of a younger age and smaller size class. Goat grazing could be used to minimize shrub encroachment and to convert existing shrublands back to grassland mosaics.



LEGEND

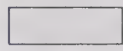
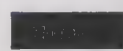
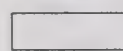
-  Oak/bay woodland
-  Coyote brush scrub
-  Non-native grassland
-  Coniferous Forest (Monterey Pine/Cypress)
-  Developed Areas
-  Trails
-  Drainage

Figure 4

VEGETATION MAP

*Leona Canyon Regional Open Space Preserve
Land Use Plan*

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Riparian and Wetland

A mostly intermittent creek extends through the open space along the canyon bottom. A portion of this drainage contains year-round water that originates from natural springs and artificial storm drains. The woody vegetation along the length of the drainage is indicative of the surrounding oak/bay woodland with scattered California buckeye. Some isolated pockets of willow and white alder occur interspersed along the streambank where water is available at or near the surface. Understory vegetation along the banks consists primarily of California blackberry, poison oak, and other shrubs in lesser amounts. The creek drains into a sedimentation pond on the south end of the property, which sustains a cattail marsh and a willow thicket, along with other wetland plants. Several natural springs supporting wetland vegetation occur on the open space.

Wildlife

Prior to field visitation, a data search for wildlife observational and locational information was performed. Records from the California Department of Fish and Game's Natural Diversity Database were searched to disclose any rare species. Additionally, consultant reports and other data sources (including Audubon Society bird surveys) were checked for relevant information. Site visits were conducted during the spring of 1997 and summer/fall of 1998 to record data pertaining to observed and expected wildlife species. No recent trapping surveys for the Alameda whipsnake have been performed in the area.

The park supports a diverse array of wildlife species and habitats which include grasslands, brush and scrub habitat, willow-lined springs and oak/bay woodland. In addition, there is a sedimentation pond (ACFCD) which supplies a permanent water source for local wildlife use. While there is some overlap in habitats, the valley corridor of the park acts as a dividing line between the brush and grass-covered west and southwest-facing slopes and the oak/bay woodlands which mostly cover the east- and northeast-facing slopes. Due to the contrasting plant communities, several wildlife species are distinctly associated with these areas.

Grassland and Brushland

The eastern half of the park is more likely to support grassland and scattered brushland, especially in the northern reaches of the park. This type of habitat is home to the state and federally threatened Alameda whipsnake which forages among the rocky outcrops and vegetation for Western fence lizards, their main source of food. A slender black snake with one yellow or orange stripe running along each side of its body and a yellow-orange ventral color, the whipsnake can occasionally be observed foraging for lizards where it uses its keen eyesight and great speed to search and capture its prey. Potential habitat for the Alameda whipsnake is shown in Figure 5.

Numerous birds forage and nest in the brush and grass-covered slopes including the California thrasher, a secretive relative of the mockingbird, song and golden-crowned sparrows, Bewick's wren,

California and rufous-sided towhees and the noisy scrub jay. Beneath the thatch layer are skunks, terrestrial garter snakes, meadow voles, Western harvest mice, and pocket gophers. Deer and raccoon leave discernable tracks on the road as they cross through the park.

Oak/Bay Woodland

The cool, shaded environment formed by the dense canopy of the oaks and California bay laurel community adds mystery to the park. Capturing the fog which blankets these hills, this moist environment houses a world of birds. Nesting Cooper's hawks and great horned owls appear as silhouettes and hunt the scurrying songbirds and rodents. Foraging flocks of mixed passerines, including Townsend's warbler, ruby-crowned kinglets, chestnut-backed chickadees, and juncos, chirp and sing their ways through the treetops, foraging on the abundant insect larvae clinging to the leaves and branches. Deer appear and then vanish within the shadows of the woodlands while trails used by gray fox, brush rabbits and skunks appear lifeless during the daylight.

Wetlands and Springs

A pond, managed by the ACFCD, exists at the south end of the park. Initially put in to desilt the flows of seasonal water and catch runoff from developments upstream, it serves as a breeding location for Pacific tree frogs and possibly newts and toads. Its perimeter choked by cattails, the pond supports breeding and foraging songbirds and red-winged blackbirds. Wet springs drain from the slopes within the park and filter their waters to this pond all year, along the way supporting wetland plant communities and quality wildlife forage.

State and Federal Listed Species

Leona Canyon Open Space Preserve provides habitat for the Alameda whipsnake, a State and federal threatened species, protected by the Endangered Species Acts (CDFG & USFWS). The snake is associated with brushland habitat and may be found in adjacent grassland interfaces. There have been no identified sightings of the whipsnake within Leona, however it is known to occur in similar habitat in the vicinity. Cooper's hawk, a state species of special concern (CDFG), occurs on site and may nest in the oak woodlands.

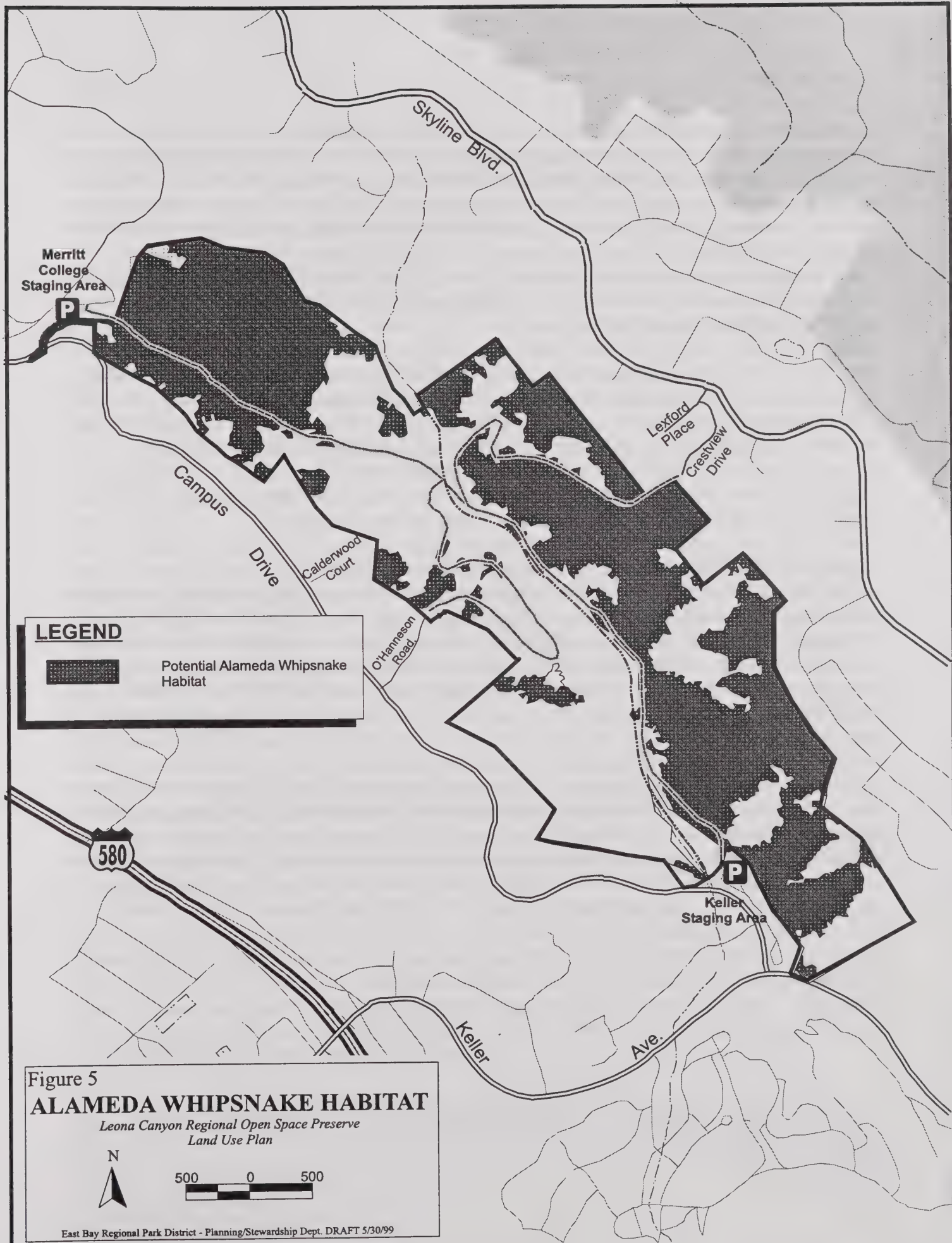


Figure 5
ALAMEDA WHIPSNAKE HABITAT

*Leona Canyon Regional Open Space Preserve
Land Use Plan*



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Geology/Soils

The majority of the site is underlain by Leona rhyolite, an igneous rock believed to be of the Pliocene age. Pyrite ore, an iron sulphide, occurs in a fracture zone in the rhyolite. Rhyolite is the only rock in Alameda County containing disseminated pyrite crystals. On the east side of the Rifle Range Branch of the Arroyo Viejo Creek is the Cretaceous Joaquin Miller Formation, which consists of shale, sandstone, and conglomerate. These formations are separated by the Chabot Fault, whose topographic expression is the steep, narrow canyon of the Rifle Range Branch. Soils derived from these rocks are sandy clays or silty clays. The silty clays derived from the rhyolite support a vegetation of unusual richness and diversity. Other active faults in the region include the Hayward, Calaveras, and San Andreas faults.

Portions of the site have experienced slope stability problems. These areas have been identified in previous reports prepared for the area including the Mountain Village EIR and the Caballo Hills EIR. These mapped areas have not caused significant erosion or landsliding problems within the parkland. However, a damaged energy dissipator at Calderwood Court has resulted in the formation of a significant erosion gully and debris slide in the western portion of the park (Figure 3). The erosion gully extends from the catch basin behind the homes located at Calderwood Court down Calderwood Canyon, to the Rifle Range drainage channel.

Runoff from all of the lots located on Calderwood Court is collected in a concrete drain that runs around the perimeter of the lots and is discharged through a single culvert into an energy dissipator that funnels into Calderwood Ravine. The energy dissipator was constructed by Ridgmont Development Company at the base of the concrete drain to divert a natural water course in the vicinity of Calderwood Court. Through the years, the runoff has carved a huge gully in the hillside that is, in certain locations, approximately 25 feet deep and 10 feet wide. The erosion resulting from the failure of the energy dissipator was brought to the Park District's attention approximately six years ago.

A field visit to the site in late summer of 1998 revealed that no significant additional erosion damage has occurred since 1992. The dissipator remains in the place where it fell and provides minimal dissipation benefits. The erosion at the top of the gully is down to the bedrock in places, and there does not appear to be opportunity for additional erosion of soils and rocks. However, at the mouth of the slide, near the creek, the debris and outfall has covered the bases of the oak and bay trees in the original creekbed. The gravel and rock has settled and filled in portions of the channel.

Hydrology

The property is within the Arroyo Viejo watershed, which drains the Oakland Hills in the surrounding area. Two main drainages are present within the park (Figure 3). Both drainages are intermittent and are supplied by water from runoff and seep discharge. The blue-line drainage course on site is named the Rifle Range Branch of the Arroyo Viejo Creek. An additional unnamed creek runs the length of the canyon eventually connecting with the Rifle Range Branch.

The Rifle Ranch Branch enters the park in the northeastern corner, traveling southward until it reaches the canyon bottom, terminating at the ACFCF detention basin at Keller Avenue. A culvert diverts overflow from the detention basin to the other side of Keller Avenue where it is discharged into the Rifle Range Branch traversing the Oak Knoll Naval Hospital property. OSCAR includes policies and action plans for protecting this drainage course and its associated riparian corridor. No fill would be allowed in this protected area.

C. CIRCULATION

Access and Staging Areas

The parkland is accessible via four park entrances, and is secured at all access points with a District gate. The two primary public access points are located at the northern and southern ends of the park (Figure 3). The northern staging area is located within Merritt College and is accessed via Campus Drive, off Redwood Road. The southern staging area is located within the Ridgemont at Keller condominium development. Access to this staging area is off Keller Avenue and through the parking lot provided for the residents of the condominiums. Both staging areas provide parking and are identified by EBRPD gates and signs. Equestrian parking is not allowed at either staging area.

The Merritt College Staging Area is approximately 365 square feet in size and is located at the southern end of the campus parking lot (Parking Lot E). The staging area is open from Monday through Saturday during the regular school year and during summer session. The outer gate to the college campus is secured by campus security (Alameda County Sheriff's Department). Due to its location within the College campus, there is a parking fee of \$0.50 per day, Monday through Friday. The Merritt College staging area is patrolled by both the campus security and the Park District Police Department.

The Keller Staging Area is located within the Ridgemont at Keller Condominium Complex, and is identified by EBRPD gates located at the north end of the condominium complex. This staging area was developed concurrent with the construction of the condominiums, and was included in the original dedication of land to the District by the Ridgemont Development Company. The Keller Staging area includes approximately 20 parking spaces and a "Mutt Mitt" station. The Park District is responsible for the patrol of this staging area.

Two local access points are available to park users, along the two easements dedicated for patrol and maintenance, commencing at the western and eastern perimeters of the parkland (Figure 3). Skyline

Boulevard provides access to Crestview Drive, which continues west into Richmond Road, the emergency vehicle maintenance access road (E.V.M.A.) leading into the park. A Park District gate is located where Richmond Road terminates at Lexford Place. There is limited parking available at this entrance, and limited access for local residents. The second local access point is located off Campus Drive, via O'Hanneson Road, an unpaved E.V.M.A. road. This access point is similarly limited to local residents.

Public Transportation

Public transportation to the park is provided by Alameda County (AC) Transit (Line 46A). The southern end of the park is served by a commuter bus that runs from Mountain Boulevard up Keller Avenue, with stops at the intersection of Keller and Campus Drive. AC Transit runs multiple buses along Skyline Boulevard, making stops at the intersection of Lexford Place with Skyline Boulevard. Additional public transportation is available to the northern staging area located within Merritt College, via AC Transit.

Trails

The Leona Heights Trail traverses the canyon from north to south. The trail is approximately one mile long, and is accessed via the two staging areas located at the southern and northern ends of the park. Two additional multi-use trails originate on Skyline and Campus Drive, and continue down into the park, connecting to the Leona Heights Trail. The trails are approximately ten feet in width and primarily unpaved. Park District staff performs routine maintenance activities on an as-needed basis including erosion control, brush clearing, and minor grading.

There are no regional trail connections between Leona Canyon Open Space Preserve and other public open spaces. However, the parkland is located in close proximity to other parks including Anthony Chabot (EBRPD) and Leona Heights Park (City of Oakland). The historic York Trail alignment runs through the parkland and at one time provided connections from Leona Heights City Park to Anthony Chabot. This historic trail corridor was approximately 3.5 miles in length and began at Mountain Boulevard in Leona Heights Park, continuing eastward following Leona Creek up the canyon, skirting the Merritt College Campus and entering what is now Leona Canyon Open Space Preserve, north of Sugarloaf Peak, and heading up a steep canyon to Anthony Chabot Park. The York Trail is no longer a passable trail connection; however, the historic corridor is still located within or adjacent to publicly owned land.

D. FACILITIES

Alameda County Flood Control District Detention Basin

The Alameda County Flood Control District (ACFCD) currently performs vegetation management functions on its 3.8-acre parcel, which is located entirely within the parkland boundaries. The Flood Control District coordinates with park staff to identify maintenance activities, priorities, and timing. However, there is not a formal agreement outlining the responsibilities and limitations of each agency. In 1989, the Park District drafted a "License Agreement for the Connector Road" which described and provided authorization for any activities related to access, types of recreational use, operation, maintenance, and repair. The agreement was never formalized, and the use of this area by both parties relies on verbal communication and coordination.

PG&E Electrical Lines

A set of electrical lines traverses the site east to west, from Hansom Drive, across the canyon, terminating at the house located on the McKell property. These lines currently provide service only to the structures located on this recently acquired parcel.

McKell Property

The McKell property, acquired in November 1998, is located in the western portion of the park adjacent to Stone Ridge Court, and includes a house, a shed, a corral, and various out-buildings. These structures date back to approximately 1935. The house is a log cabin and is serviced only by electrical utilities. A collapsed septic tank is located on the property as well as several water barrels. The property has been occupied intermittently through the years and has experienced damage from at least one fire.

E. PUBLIC SAFETY SERVICES

EBRPD provides for the safety and protection of park visitors and staff, the protection of natural resources and facilities, and the protection of adjacent neighbors and their property in conjunction with local public safety agencies. Measures employed to manage public safety risks include a vegetation management program, an emergency communications system, and on-site police and fire presence as required. The EBRPD's Public Safety Department participates fully in county and state Fire and Police Interagency Mutual Aid Systems for disaster situations. These agencies also maintain cooperative working agreements with local police and fire jurisdictions to assure prompt response in emergencies.

Overall police, fire, and rescue services within the District begin with early assessment of the specific needs of any given facility and the design and prevention/mitigation strategies as the individual facilities are acquired and developed. These assessments continue as the character and use of the facility changes. Police implementation strategies include helicopter, motorcycle, dirt bike, 4X4 vehicle, mountain bike, horse and foot patrol as well as the traditional forms of vehicle

patrol. Fire Department implementation strategies include staffing District fire stations during peak use periods, recalling firefighters from other assignments and off duty as needed, helicopter patrol for fire detection and emergency response, fire prevention inspections, and responding to fire/rescue incidents.

The Oakland Fire Services Agency has primary fire and Emergency Medical Service (EMS) response jurisdiction because the parkland is located within the Oakland city limits. The EBRPD Fire Department would also respond to incidents within the parkland because they have the equipment (including smaller Type 4 engines for better access) and the expertise in wildland and back country orientation to provide services in wildland areas. The parkland is also located within a "Mutual Threat Zone" in which the California Department of Forestry provides services and equipment if requested. HAZMAT responses would be provided by the EBRPD.

Response times to the parkland from the Oakland Fire Department would range from five minutes (Joaquin Miller and Butters Station) to the north end of the park, to eight minutes (Skyline and Parkridge Station) to the south end of the park. The EBRPD Fire Department would provide emergency service from three stations located in the vicinity, and response times would range from 15 to 20 minutes. If available, CDF would dispatch aircraft to Leona Canyon Open Space Preserve from the Alma Station located in the Santa Cruz Mountains and fire engines from the Sunshine Forest Fire Station located in Contra Costa County. Fixed wing aircraft would normally come from Santa Rosa and/or Hollister Airbases if available.

Patrols of the parkland and staging areas are performed by the Park District on a regular basis. The Alameda County Sheriff's Department patrols the staging area at Merritt College daily. The Sheriff's Department has a small satellite office on campus, which is staffed Monday through Saturday 6 a.m. until 12 a.m. From 12 a.m. until 2 a.m., the Sheriff's Department would respond with officers from surrounding beats; the Oakland Police Department would respond to emergencies in this area after 2 AM.

F. FIRE HAZARD

Wildland fire prevention is an important concern within Leona Canyon Open Space Preserve. The vegetation on the northeast-facing slopes of the canyon consists primarily of evergreen trees (oaks, bays) that are relatively fire-resistant. These slopes would help to provide a natural break that will slow the spread of fire and reduce flame lengths. The southwest-facing slopes support mostly dense shrub growth with a higher fire danger rating. There has been a history of wildland and domestic fires within the Leona Canyon and surrounding open spaces.

The East Bay Hills Vegetation Management Consortium's (VMC) "Fire Hazard Mitigation Program and Fuel Management Plan" outlines a planning process for defining a "fuel break study zone" (approximately 500 feet in width from edge of structure to wildland) and techniques to be used to achieve defensible space and the eight-foot flame length standard within this study area. Within this study area, fire hazard mitigation treatment can be further broken down into two types of zones. "Fuel Modification Zones" are managed to reduce the overall level of fire hazard by manipulating the existing conditions through the removal of built-up vegetation, thinning dense stands of trees, and removing understory materials that create fire ladders. The second treatment zone is a traditional "Fuel Break," which would be strategically located to slow the advance of major wildland fires by reducing fire intensity and resistance to control.

The identification of these two types of fire hazard treatment zones is dependent upon the steepness of the slope, the type of vegetation within the area, proximity of "values at risk" (residential areas and evacuation routes) and accessibility factors. The ultimate objective is to achieve a flame length of eight feet or less at the point that firefighters will attempt to defend structures or other "values at risk".

For the preparation of this Land Use Plan, a 500-foot fuel break study zone was identified between the "values at risk" and wildlands. The vegetation and steepness of the slope were mapped within these areas, resulting in treatment zones where fuel modification would be necessary to meet the objectives of the East Bay Hills VMC and the EBRPD. The treatment zones include three "fuel breaks" located on the southeast and southwest perimeter. These three fire hazard treatment zones total approximately 17 acres (6%) of the 289 acre parkland, and are identified in Figure 7.

In addition, Sugarloaf Hill has been identified as a high fire risk area due to its dense brush intermixed with grassland vegetation and its location at the top of a steep canyon. Sugarloaf Hill also represents good habitat for the Alameda whipsnake; however, lack of management of this area has reduced its habitat value because of excessive canopy closure and decadence in the shrubland vegetation.

The fuel break zones and Sugarloaf Hill area identified in this plan have been incorporated into the Park District's application for a grant from the Federal Emergency Management Agency (FEMA) for funding for vegetation management for fire prevention within the parkland. The FEMA grant

also includes fire management projects within other East Bay hill parks in the District that have been identified as having a potential for reducing fire risk.

IV. LAND USE PLAN

The open, natural character of Leona Canyon Open Space Preserve will be retained in the Land Use Plan; no significant development is proposed. In addition, the Land Use Plan does not propose any changes to the types of use currently associated with the park. The park's designation as an open space preserve will be maintained as a result of the policies identified below.

This Land Use Plan identifies management priorities and responsibilities for areas within the parkland to ensure that the parkland is a resource that can be appreciated by both park users and neighboring residents, while providing fire protection.

A. Land Use Zones

The EBRPD Master Plan classifies Leona Canyon Open Space Preserve as a regional preserve. This classification is based on Leona's outstanding natural resources, including the vegetation and habitat features described above. The Master Plan identifies objectives for regional preserves, including the preservation and protection of significant natural or cultural resources. Development criteria for uses in regional preserves include the designation of no more than five percent of the total preserve area for Recreation/Staging Units, which provide public access and services.

The District establishes Land Use Designations (unit designations) to indicate the various levels of resource protection and recreational density within each parkland. These unit designations include both Natural Units and Recreation/Staging units. The Master Plan defines Natural Units as areas designated for lower intensity recreational use, in which the primary objective is the preservation and enhancement of natural habitat. Recreation/Staging units include the developed features of the parkland, which can provide access, parking, rest rooms, picnic areas, play structures, camping facilities, etc.

Natural Units

The entire 289-acre parkland is zoned a Natural Unit. This zoning ensures the preservation and enhancement of the natural habitat within the park, and provides opportunities for passive recreation, including hiking, biking, jogging, education, and plant and wildlife study.

Recreation/Staging Units

There are currently two staging areas located at the southern and northern ends of the park which are zoned Recreation/Staging Units. These staging areas provide ample parking for park users and include developed features common to District staging areas, including signs, trail identification, and "Mutt Mitt" stations. Neither staging area provides potable water or restroom facilities. No additional facilities are proposed. Because both staging areas are located adjacent to existing development, sensitivity is required on both the District's and the park users part in maintaining and respecting the shared resources.

Special Protection Features (SPF)

Special Protection Features (SPF) identify areas with unique or fragile natural, cultural, aesthetic or educational features. This designation provides protection for resources that require specialized types of management to preserve and enhance them. The only SPF located within the Leona Canyon Open Space Preserve area are the shrubland areas considered prime habitat for the Alameda whipsnake. These areas, identified in Figure 5, will be managed for the Alameda whipsnake using the plan recommendations outlined below.

Special Management Features (SMF)

Special Management Features (SMF) primarily identify constructed features that require special types of management. SMF located on site include fire hazard treatment zones (fuel break areas) identified in Figure 7. Management guidelines for these areas are outlined below.

B. PUBLIC ACCESS AND CIRCULATION

Signs

Currently, there are no directional signs identifying the location of the two staging areas at Merritt College and off Campus Drive at Keller Avenue. Both of these staging areas are located within non-District property. To facilitate appropriate entrance into the park, signs would be necessary off the two main streets accessing the park (Keller Avenue and Campus Drive). In addition, the two local access points at Skyline and Campus are not identified by Park District signs. To encourage the local use of these two entrances, it would be beneficial to install signs at each of the entrances to the park off Skyline Boulevard and Campus Drive and at local intersections surrounding the parkland. The proposed locations for these signs are identified in Figure 6.

Pedestrian connection from Campus Drive to Merritt College Staging Area. Trail alignment within road right-of-way

Merritt College

Anthony Chabot Regional Park

Skyl ine

Trail

Campus Drive

Skyl ine

Brookpark

Saddle Brook Road

Blvd.

Parkridge

Drive

Clairepointe Way

Vista Madera Stables (City of Oakland)

Goldenrod Tr.

Campus Drive

Artemisia Trail

Lexford Place

Crestview Drive

Trail Connection to Anthony Chabot (Goldenrod Trail)

Natural Unit

- * Provide fire protection & fuel reduction in high fire hazard areas.
- * Provide habitat protection & enhancement for the Alameda whipsnake.
- * Retain the park's natural quality while providing enhanced access opportunities

Pyrite Trail

Arroyo Viejo Trail

O'Hanneson Road

Campus Drive

Trail Connection to Oak Knoll Naval Hospital

580

Mountain Boulevard

Keller Ave.

Oak Knoll Naval Hospital

Figure 6

LAND USE PLAN

Leona Canyon Regional Open Space Preserve
Land Use Plan



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East Bay Regional Park District - Planning/Stewardship Dept. DRAFT 5/20/99

- Natural Unit
- Staging Area
- Trail Connection
- Park Direction Signage

Install directional signs at Redwood Road/Campus Drive, Keller Avenue/Mountain Boulevard and Keller Avenue/Campus Drive intersections and at entrances to both Merritt College and the Ridgemont at Keller Condominiums to clarify location and direction of staging areas.

Install signs within Merritt College, directing internal traffic to the staging area located at the southern end of campus (parking lot E).

Install signs at the local access point on Skyline Boulevard (at Lexford Place) and on Campus Drive (at O'Hanneson Road).

Install signage identifying trail connection routes to Anthony Chabot Regional Park and Oak Knoll Naval Hospital as described below in "Trails" policies.

Improve signage at both staging areas to encourage interpretation and natural resource appreciation.

Keller Staging Area

The Keller Staging Area is located within the parking area of the Ridgemont at Keller Condominium complex. The proximity of the staging area to adjacent homes necessitates a coordinated effort on the parts of the Park District, the park users, and the adjacent residents to share this resource. To increase safety and security of this staging area, the following policies shall be implemented:

Create a single access point entering and exiting the Staging Area to provide one entrance and exit.

Install lights in the parking lot to improve nighttime visibility and security.

Continue to monitor the staging area for trespassing, littering, and any activities considered inappropriate for District staging areas.

Merritt College Staging Area

There are no known security problems at the Merritt College Staging Area; however, access is limited to those hours that the campus is in operation, Monday through Saturday during the school year. Park users attempting to utilize this staging area on Sundays and holidays are currently prohibited from entering the college campus.

Coordinate with Merritt College and the Alameda County Sheriff's Department (campus security) to allow weekend access and holiday access into the Merritt College Staging Area.

Utilize the existing fire road located on the Merritt College property as an alternate pedestrian access route to the Merritt College staging area when the college parking access is closed. Park users would park along Campus Drive and walk the short distance to the staging area. Signs would be installed on Campus Drive and along the fire road to identify this alternate access route.

Trails

Two future trail connections are proposed as part of this Land Use Plan. These connections are displayed in Figure 6, and would not entail any new construction. Signs would be installed to direct park users and adjacent residents to the trail connections, which would provide access to the Oak Knoll Naval Hospital property and Anthony Chabot Regional Park. These trail connections would utilize pre-existing streets and rights-of-way, and would consist primarily of pavement connections. All trail connections would be identified on EBRPD maps and publications. To the extent possible, signs identifying the connections will be installed.

Identify a future trail connection to the Oak Knoll Naval Hospital at the southwestern end of the parkland.

Continue coordination with the City of Oakland in the planning and development of the Oak Knoll Naval Hospital property, including the development of a regional trail connection between Leona Canyon Open Space Preserve and the Naval Hospital property.

Identify a trail connection to Anthony Chabot via Crestview Drive (Artemisia Trail) to Skyline Boulevard, continuing on to the Oakland City Stables and connecting to the EBRPD Goldenrod Trail.

Work with the City of Oakland to re-establish the historic York Trail alignment utilizing existing city trails, EBRPD trails, city roads, and public rights-of-way.

Continue to evaluate local access opportunities and trail connections between Leona Canyon Open Space Preserve and the vicinity.

With the exception of the Leona Heights Trail, most of the on-site trails have not been formally named. This Land Use Plan includes name changes for all of the trails located within the park boundaries. These names have been selected to reflect the natural and historical features of the park, and correspond to unique native features found on or adjacent to each trail. These trail names are identified on the Land Use Plan, Figure 6.

Change the name of the Leona Heights main trail to the "Arroyo Viejo Trail", which follows the Rifle Range Branch of the Arroyo Viejo Creek through the entirety of the park, in order to reflect the local watershed that this park drains into.

Name the trail extending from O'Hanneson Drive to the Arroyo Viejo Trail (Leona Heights main trail) the "Pyrite Trail" to reflect the pyrite crystals found in the rhyolite deposits located within and adjacent to the parkland, and to encourage awareness of this significant geological resource.

Name the trail that runs from Crestview into the park, terminating at the Leona Heights Main trail, the "Artemisia Trail" to reflect the native shrubland habitat commonly found on these west-facing slopes.

Other

Review development proposals for the Gallagher and Burk property to identify potential opportunities for the acquisition of land to provide a small staging area and access into the parkland.

C. FACILITIES AND MAINTENANCE

Erosion Control

Annually monitor the debris outfall and slide at the Calderwood Ravine to ensure that the slide is not increasing in size or resulting in significant new damage to the parkland.

Encourage the homeowners at Calderwood Court to routinely inspect their storm drainage system and clean it out after large storms.

Work with local non-profit groups (i.e. Friends of the Oaks and volunteers) to clear the large debris from the base of the oak trees at the mouth of Calderwood Ravine.

Correct existing erosion problems along trails, primarily by the placement or repair of culverts or the natural diversion of runoff, seep and drainage flow. Continue the existing trail maintenance and grading program.

Alameda County Flood Control District (ACFCD) Detention Basin

The Alameda County Flood Control District currently performs vegetation management functions on its parcel located entirely within the parkland boundaries. The Flood Control District coordinates with park staff to identify management activities, priorities, and timing. However, there is not a formal agreement outlining the responsibilities and limitations of each agency. Previously, the Park District drafted a "License Agreement for the Connector Road" which described and provided authorization for any activities related to access, types of recreational use, operation, maintenance, and repair. The agreement was never formalized, and the use of this area by both parties relies on verbal communication.

Develop an "Operating Agreement" in cooperation with ACFCD, identifying management responsibilities for the area shared by both agencies, including but not limited to, vegetation management, integrated pest management, and public access.

McKell Property

The recently acquired 10.31-acre McKell Property includes a residence, shed, corral and associated outbuildings on the premises. A preliminary Historic Survey has not identified any significant architectural or historic value to this property. Due to the dilapidated condition, remote location, fire hazard and lack of services and utilities to the site, the residence and structures would not be suitable for a Park District security residence or corporation yard. The costs associated with upgrading the structures to building code and EBRPD standards would total approximately \$155,000. Therefore, this Land Use Plan proposes the demolition of the McKell House and associated structures to meet the objectives of park staff and the goal of maintaining this parkland as an Open Space Preserve. Upon demolition, the property would be returned to natural open space in order to blend in with the surrounding oak/bay woodland and shrubland habitats.

Demolish the McKell House and associated structures and return the property to open space.

PG&E Electrical Lines

The electrical lines that cross the project site from Hansom Drive terminating at the McKell property present a fire hazard and a visual deterrent from the open space quality of the Leona Canyon Open Space Preserve.

Work with PG&E to coordinate the removal of the on-site transmission lines in conjunction with the demolition of the McKell structures.

D. INTERPRETATION

Merritt College

The students and staff of Merritt College have traditionally used Leona Canyon Open Space Preserve for educational and recreational purposes. The valuable natural resources within the park provide "hands-on" opportunities for students taking classes in the natural sciences to observe and identify native plants and their habitats.

Continue to encourage the use of Leona Canyon Open Space Preserve by students and staff at Merritt College for recreational and educational purposes.

Develop an "Interpretive Map and Guide" for Leona Canyon to be used by students at Merritt College that would identify and locate the natural resources within the parkland, including, but not limited to, sensitive habitats, native plant species, and plant communities.

E. RESOURCE MANAGEMENT

The District will use a variety of methods, including hand clearing, prescribed fire, goat grazing and mechanical and/or herbicide treatments as resource management tools to reduce the threat of wildfire, maintain plant and animal diversity, provide defensible space between the wildland/urban interface and preserve the existing character of the canyon. The following policies carefully balance these resource management strategies to protect and enhance the habitat of the threatened Alameda whipsnake and native plant communities, while reducing the risk of fire along the urban wildland interface surrounding the park.

Vegetation

The following vegetation management policies and discussion are for plant communities identified in Figure 4. These general vegetation management goals are consistent with standard EBRPD practices and would be implemented on an as-needed basis, as determined by Park District staff to achieve goals of habitat enhancement, fire hazard reduction, and sensitive species protection.

Oak/Bay Woodland

Park woodlands, in general, are managed under a conservation-oriented approach that allows and encourages natural, ecological processes to take place. Prescribed fire and/or mechanical treatment are methods used in limited situations to reduce fire hazard conditions, influence understory plant composition, and sustain the production and recruitment of tree species. The woodland occurring within the open space is characterized as oak/bay woodland, which is a relatively fire-safe, natural plant community comprised primarily of evergreen trees and shrubs.

Manage oak/bay woodlands under a conservation-oriented approach that allows and encourages natural, ecological processes to take place.

Shrubland

A coyote brush/California sagebrush/poison oak shrub association forms virtually impenetrable thickets along the canyon's southwest-facing slopes. Coyote brush and poison oak continue to colonize open grassland environments in the absence of historical burning and grazing practices. Shrublands are an important community type to be managed for their intrinsic value as a naturally functioning ecosystem. Efforts to achieve fire control and resource management objectives will be consistent with maintaining shrubland community dynamics.

Shrublands will be managed to maintain a mosaic pattern of open grass and shrub vegetation through an overall reduction of the fuel load and the conversion of closed-canopy shrubland to pockets of open-canopy shrubland scattered throughout the grassland. This would be accomplished through a combination of hand clearing, prescribed fire, goat grazing and mechanical removal and/or

herbicide use. Infestations of French broom and other non-native shrubs would be controlled through mechanical removal or herbicides.

Shrubland communities on the northeast-facing slopes and on portions of the southwest-facing slopes may provide habitat for the threatened Alameda whipsnake (see Figure 5). Fortunately, management prescriptions that enhance the quality of the habitat for the whipsnake can also prevent an accumulation of fire fuels. District staff participates on the USFWS Recovery Team for the Alameda whipsnake. The following prescriptions are in accordance with the most recent recommendations of the USFWS. District staff will continue their efforts to update knowledge about the range and habitat requirements of this threatened animal which might occur in Leona Canyon Open Space Preserve and will modify their management practices as is appropriate to protect them. The District will implement the following policies on a case-by-case basis to achieve concurrent objectives of reducing fire hazards and rejuvenating fire-adapted shrubland communities.

Utilize hand clearing, prescribed fire, goat grazing and mechanical methods and/or herbicide treatments for the management of shrubland vegetation, if necessary. The need for such management will be assessed on a case-by-case basis.

Initiate vegetation management on Sugarloaf Hill as a priority to reduce the existing fuel load and enhance Alameda whipsnake habitat.

Control infestations of French broom and other non-native shrubs through mechanical or chemical treatments.

Time and execute treatments to create a mosaic of different successional stages within the shrublands and to have the least impact on the Alameda whipsnake in accordance with recommendations from the USFWS.

Obtain permits from the CDFG and USFWS to allow the implementation of vegetation management and the potential "take" of the Alameda whipsnake during the course of vegetation management activities.

Grassland

Grasslands support a variety of plants and animals, including numerous seasonal wildflowers which bloom in the spring and summer. Existing and future grassland areas within the park would be managed to control the proliferation of exotic grasses and other vegetative fuels, maintain a diversity of native and non-native herbaceous plants, and minimize brush encroachment and canopy closure to prevent the loss of diversity and the build-up of fuels. This would be accomplished primarily through prescribed burning and goat grazing. Management prescriptions for grasslands would enhance the quality of habitat for the Alameda whipsnake while reducing the fuel load and encouraging plant diversity. Maintaining grasslands with scattered brush and an open canopy allows

continued use by whipsnakes and their prey, greater opportunity for thermoregulation, and increases the vigor and recruitment of young stands of brush.

Prescribed burning would be conducted after most native plants have matured and dispersed seed and the herbaceous vegetation has dried adequately to carry a fire. This would occur in late summer through early winter to mimic the pattern of historic fires. The goats would be systematically rotated to different locations until overall residual dry matter (RDM) standards of 800 to 1000 pounds of plant litter per acre were achieved. A photo guide depicting appropriate RDM levels would be provided to the goat operator. Areas containing sensitive resources such as wetlands, seeps or springs, would be avoided

Manage grassland areas on the preserve using prescribed burning and goat grazing to reduce vegetative fuels, maintain a diversity of native and non-native herbaceous plants, and minimize brush encroachment.

Monitor goat grazing activities to ensure that desired grazing levels are not exceeded. Adjust grazing practices, as necessary, to achieve appropriate residual dry matter (RDM) standards, encourage the spread of native plant species and enhance wildlife habitat.

Wildlife

Wildlife management priorities include the maintenance and enhancement of existing Alameda whipsnake habitat and the overall diversity of species occurring within the park.

The District staff will continue past efforts to determine the range and habitat requirements of this threatened snake which might occur in Leona Canyon Open Space Preserve and will modify their management practices as is appropriate to protect them. Vegetation management policies identified above would maintain and improve the habitat of the Alameda whipsnake. Implementation of habitat management activities described above will require permits from the CDFG and USFWS Federal Endangered Species Act (FESA) to allow "take" of the snake during the course of mechanical treatment or prescribed burns. The District will secure a permit through Section 7 or Section 10A of the Federal Endangered Species Act and either a take permit pursuant to Section 2080 of the State Fish and Game Code or a Consistency Determination (Section 2080.1). Adaptive management strategies will be implemented based on the most current knowledge of the snake's natural history and on future research.

Additionally, Leona Canyon houses a variety of wildlife species, identified in Appendix B, adapted to the vegetation which has evolved within the park. Brushland, which is habitat for the threatened whipsnake is also home to various nesting birds and reptiles. California thrashers, towhees and Bewicks wrens nest in the shrubland. Skinks, alligator lizards and western fence lizards are commonly found in the oak woodland, the brushland and grasslands. Many species rely on water from the seeps and ephemeral drainages and from the adjacent Alameda County Flood Control District (ACFCD) detention basin. Cooper's hawks and great-horned owls nest in the dense oak/bay woodlands and feed on the abundant birds and rodents in the park.

Continue to collect data on the occurrence of the Alameda whipsnake within the parkland. Update knowledge about the range and habitat requirements of this animal and modify management practices as appropriate to protect them.

Continue to participate in the USFWS Recovery Team for the Alameda whipsnake.

Protect and enhance the Alameda whipsnake habitat through the implementation of the vegetation management and fire management policies identified in this plan.

Prohibit any fire management or maintenance activities within 1/8 mile of active Cooper's hawk nesting sites until the young have fledged.

Conserve wildlife populations to foster native species and protect or increase the population of endangered species.

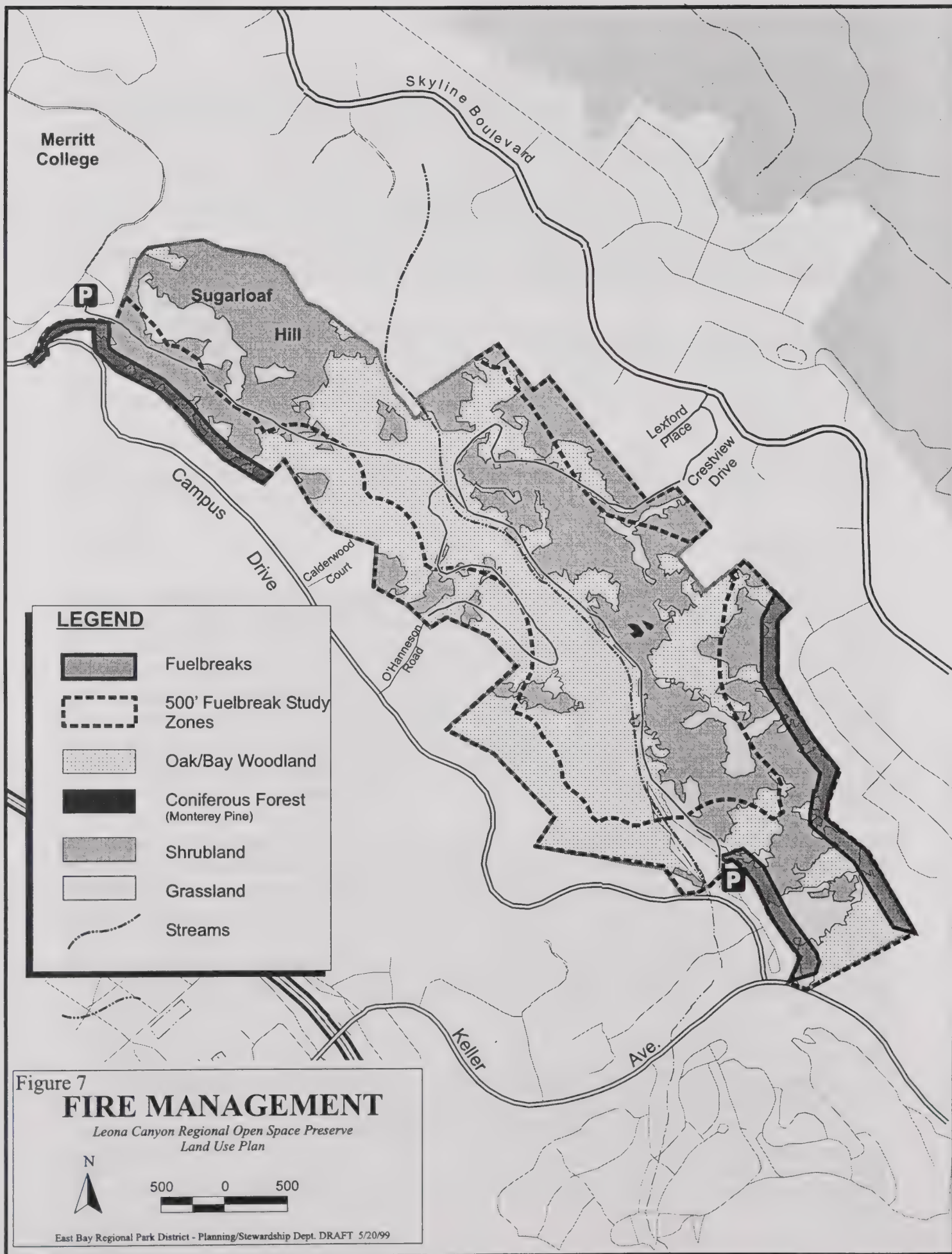
Coordinate with ACFCD to ensure that maintenance of the flood retention basin is sensitive to its importance as wildlife habitat.

Fire Management

The following policies implement recommendations from the Vegetation Management Consortium's 1995 "Fire Hazard Mitigation Program and Fuel Management Plan for the East Bay Hills" for the reduction in fire hazard in areas where urban development mixes with wildlands. Three areas within the fuel break study zone (500' from edge of structure to wildland) have been identified as fuel breaks where vegetation will be actively managed to achieve defensible space and the eight-foot flame length standard defined in the fire hazard plan (see Figure 7). These fuel breaks were identified utilizing previous fire risk studies conducted for this parkland by the East Bay Vegetation Management Consortium and studies conducted in conjunction with this Land Use Plan. Oak/Bay woodland, shrubland and grassland vegetation occurs in the fuel breaks.

The vegetation within the fuel breaks will be treated more aggressively than the areas located outside of the fuel breaks to achieve the desired eight-foot flame length standard. Fuel reduction treatments will employ the same principles as discussed above in "Vegetation Management," however, the standards for density and type of vegetation within these fuel breaks will be more stringent as described below. All fire management treatments and prescriptions will be administered per the "Treatment Prescription Descriptions" identified in the Technical Appendices of the Fire Hazard Mitigation Program and Vegetation Management Plan, included in Appendix D.⁴

⁴ East Bay Hills Vegetation Management Consortium. 1995. Technical Appendices for the Fire Hazard Program and Fuel Management Plan for the East Bay Hills. May.



Oak/Bay Woodland

The oak/bay woodland occurring within the fuel breaks is a relatively fire-safe, natural plant community comprised primarily of evergreen trees and shrubs. The overall fire hazard is low and ignition potential is dependent on understory vegetation due to the moderating effects of canopy cover. However, the oak/bay woodland community can provide a valuable fire management tool through the encouragement of dense, healthy canopy cover to shade out more flammable understory and exotic species. Methods used for fuel reduction in the oak/bay woodland communities would include manual and/or mechanical clearing and prescribed burning of litter and dead materials in the understory. This would reduce the flammability of the understory vegetation and would encourage a natural succession towards an oak/bay woodland climax community.

Manage oak/bay woodland in the fuelbreak areas to maintain fire-safe conditions through the removal of selected trees and the reduction of understory vegetation. Methods used would include hand removal prescribed burning, or mechanical treatment. Brush piles generated from these activities would be burned under controlled conditions or removed from the site.

Remove non-native trees, such as Monterey pine and eucalyptus, as necessary to achieve fire safety objectives.

Shrubland

Shrubland fire management activities would include hand-clearing, prescribed burning, goat grazing, mechanical removal and/or herbicide application to minimize the flammability and potential for ignition of the shrubland vegetation. Goat grazing in the shrubland areas of the fuelbreak would occur on a high-intensity, short-duration basis, with the season of use lasting two to three months. The goats would be herded or confined with fencing to specific blocks of land that would be grazed to achieve desired results. Taller shrub vegetation would be hand-cut or mechanically manipulated to make it available to the goats for consumption given the inability of goats to browse on shrubs exceeding six feet. Mechanically or chemically treated vegetation would either be left in place, removed, or piled and burned under controlled conditions. Piles to be burned would be designed to reduce their attractiveness to wildlife, and would be burned shortly after they are stacked. This would reduce the likelihood that wildlife would utilize the piles for habitat and shelter and be at risk during pile burning. Prescribed burning would maintain the shrubland in earlier successional stages that support plants of a younger age and smaller size class, with a greater spacing between individual plants and an open canopy, thus enhancing the diversity of wildlife habitat and reducing potential fire dangers.

Maintain shrub stands in a variety of age and size classes with a canopy cover of no more than 50% through hand-clearing, prescribed burning, goat grazing, and mechanical removal and/or herbicide application to minimize the flammability and potential for ignition of the shrubland vegetation.

Encourage the establishment of grasses and herbs in the openings with thatch sufficient to allow the protected movement of snakes.

Utilize hand cutting and clearing in those areas which have steep slopes, areas of sensitive vegetation or areas close to structures. Hand labor must be repeated every several years, depending on how much fuel is removed and how fast the vegetation grows.

Grassland

Grassland within the fuelbreaks will be managed using goat grazing and prescribed burning to reduce vegetative fuels, maintain a diversity of native and non-native herbaceous plants, and minimize brush encroachment into grasslands. Maintaining grasslands with scattered brush and an open canopy allows greater ground temperature and continued use by whipsnakes and their prey by providing a greater opportunity for thermoregulation.

Initiate goat grazing in the grassland areas of the fuel breaks when new, green, vegetative growth has reached a height of 3 to 4 inches to provide soil protection and adequate forage to sustain grazing animals. Ensure that stocking levels and the duration of grazing is commensurate with vegetative conditions and other resource management considerations, and modify, if necessary.

General

Within the 500' planning zone, develop an interagency agreement between EBRPD and the Oakland Fire Department to address the following: 1) wildfire response; 2) maintenance of defensible space; 3) agency responsibility; and 4) long term management strategies for vegetation.

Distribute vegetation management and fuel reduction guidelines for all homeowners with property immediately adjacent to the park, in order to promote the reduction of fuel loads on private property.

Appendix A: PLANT LIST

Plant List - Leona - 5/19/98 and 6/1/98

Scientific Name	Common Name	N/I	L
X <i>Achillea millefolium</i>	Yarrow	n	p
X <i>Achyrochaena mollis</i>	Blow Wives	n	a
X <i>Adiantum jordanii</i>	Fern, Calif. Maidenhair	n	p
X <i>Aesculus californica</i>	Buckeye, California	n	p
X <i>Agoseris</i> sp.	Dandelion	n	p
? <i>Agrostis exarata</i>	Bent Grass, Spike Redtop	n	p
X <i>Aira caryophylla</i>	Hair Grass, Silver European	i	a
X <i>Alnus rhombifolia</i>	Alder, White	n	p
X <i>Amsinckia menziesii</i> var. <i>intermedia</i>	Fiddleneck, Common	n	a
X <i>Anagallis arvensis</i>	Pimpernel, Scarlet	i	a
X <i>Anthemis cotula</i>	Mayweed	i	a
X <i>Anthriscus caucalis</i>	Bur-chervil	i	a
X <i>Artemisia californica</i>	Sagebrush, California	n	p
X <i>Artemisia douglasiana</i>	Mugwort, California	n	p
X <i>Avena barbata</i>	Oat, Slender Wild	i	a
X <i>Baccharis pilularis</i>	Coyote Bush	n	p
X <i>Barbarea orthoceras</i>	Winter Cress, Erect-pod	n	p
X <i>Brassica nigra</i>	Mustard, Black	i	a
X <i>Briza minor</i>	Quaking Grass, Little	i	a
X <i>Bromus carinatus</i> var. <i>carinatus</i>	Brome, California	n	p
X <i>Bromus diandrus</i>	Brome, Ripgut	i	a
X <i>Bromus hordeaceus</i>	Brome, Soft	i	a
? <i>Bromus laevipes</i>	Brome, Woodland	n	p
X <i>Bromus madritensis</i> ssp. <i>madritensis</i>	Brome, Spanish	i	a
X <i>Bromus madritensis</i> ssp. <i>rubens</i>	Brome, Red Foxtail	i	a
X <i>Calochortus umbellatus</i>	Star Tulip, Oakland	n	p
X <i>Calystegia sepium</i> ssp. <i>limnophila</i>	Bindweed, Hedge	n	p
X <i>Camissonia ovata</i>	Suncup, Golden Eggs	n	p
X <i>Carduus pycnocephalus</i>	Thistle, Italian	i	a
X <i>Ceanothus oliganthus</i> var. <i>sorediatus</i>	Jim Brush	n	p
X <i>Cerastium glomeratum</i>	Chickweed, Mouse-ear	i	a
X <i>Chamomilla suaveolens</i>	Pineapple Weed	n	a
X <i>Chlorogalum pomeridianum</i> var. <i>pomeridianum</i>	Soap Plant, Common	n	p
X <i>Cicuta douglasii</i>	Hemlock, Water	n	p
X <i>Cirsium vulgare</i>	Thistle, Bull	i	b
X <i>Claytonia perfoliata</i> ssp. <i>perfoliata</i>	Miner's Lettuce, Common	n	a
X <i>Conium maculatum</i>	Poison Hemlock	i	b
X <i>Cornus sericea</i> ssp. <i>occidentalis</i>	Dogwood, Western Creek	n	p
X <i>Cortaderia jubata</i>	Pampas Grass, Hairy	i	p
X <i>Corylus cornuta</i> var. <i>californica</i>	Hazelnut, California	n	p
X <i>Cyperus eragrostis</i>	Nutsedge, Tall	n	p

Plant List - Leona - 5/19/98 and 6/1/98

Scientific Name	Common Name	N/I	L
X <i>Dactylis glomerata</i>	Orchard Grass	i	p
X <i>Delphinium decorum</i> ssp. <i>decorum</i>	Larkspur, Coast	n	p
X <i>Dichelostemma capitatum</i> ssp. <i>capitatum</i>	Blue Dicks	n	p
X <i>Disporum hookeri</i>	Fairy Bells, Hooker	n	p
X <i>Dryopteris arguta</i>	Fern, Coastal Wood	n	p
X <i>Elymus glaucus</i> ssp. <i>glaucus</i>	Wild Rye, Blue	n	p
X <i>Epilobium ciliatum</i> ssp. <i>watsonii</i>	Willowherb, Watson	n	p
X <i>Epilobium densiflorum</i>	Willowherb, Dense-flower	n	a
X <i>Equisetum laevigatum</i>	Scouring Rush, Smooth	n	p
X <i>Eriophyllum confertiflorum</i> var. <i>confertiflorum</i>	Yarrow, Golden	n	p
X <i>Erodium cicutarium</i>	Filaree, Red-stem	i	a
X <i>Erodium moschatum</i>	Filaree, White-stem	i	a
X <i>Eschscholzia californica</i>	Poppy, California	n	p
X <i>Filago gallica</i>	Fluffweed	i	a
X <i>Fragaria vesca</i>	Strawberry, Woodland	n	p
X <i>Galium aparine</i>	Bedstraw, Goosegrass	i	a
X <i>Genista monspessulana</i>	Broom, French	i	p
X <i>Geranium dissectum</i>	Geranium, Purpletip Cut-leaf	i	a
X <i>Gnaphalium luteo-album</i>	Cudweed, Weedy	i	a
X <i>Hedera helix</i>	Ivy, English	i	p
X <i>Heracleum lanatum</i>	Parsnip, Cow	n	p
X <i>Holodiscus discolor</i>	Creambush / Ocean Spray	n	p
X <i>Hordeum marinum</i> ssp. <i>gussoneanum</i>	Barley, Mediterranean	i	a
X <i>Hordeum murinum</i> ssp. <i>glaucum</i>	Barley, Glaucous	i	a
X <i>Hordeum murinum</i> ssp. <i>leporinum</i>	Barley, Hare	i	a
X <i>Hypochaeris glabra</i>	Cat's-ear, Smooth	i	a
X <i>Hypochaeris radicata</i>	Cat's-ear, Rough	i	p
X <i>Juncus bufonius</i> var. <i>bufonius</i>	Rush, Toad	n	a
X <i>Juncus xiphioides</i>	Rush, Iris-leaf	n	p
X <i>Lactuca virosa</i>	Lettuce, Tall Wild	i	b
X <i>Lathyrus vestitus</i> var. <i>vestitus</i>	Pea, Pale Purple Pacific	n	p
X <i>Linum bienne</i>	Flax, Narrow-leaf	i	p
X <i>Lolium multiflorum</i>	Rye Grass, Awned Italian	i	p
X <i>Lonicera hispidula</i> var. <i>vacillans</i>	Honeysuckle, Hairy Vine	n	p
X <i>Lotus micranthus</i>	Lotus, Hill / Small-flower	n	a
? <i>Malva nicaeensis</i>	Mallow, Bull	i	a
X <i>Marah fabaceus</i>	Manroot, Common / California	n	p
X <i>Medicago polymorpha</i>	Bur Clover, California	i	a
X <i>Melica imperfecta</i>	Melic Grass, Coast Range	n	p
X <i>Melica torreyana</i>	Melic Grass, Torrey	n	p
X <i>Melilotus indica</i>	Clover, Sour	i	ab

Plant List - Leona - 5/19/98 and 6/1/98

Scientific Name	Common Name	N/I	L
X <i>Mimulus aurantiacus</i>	Monkey Flower, Bush	n	p
X <i>Mimulus guttatus</i>	Monkey Flower, Golden	n	p
X <i>Myosotis latifolia</i>	Forget-me-not	i	p
X <i>Nassella pulchra</i>	Needle Grass, Purple	n	p
X <i>Osmorhiza chilensis</i>	Sweet Cicely, Mountain	n	p
X <i>Pentagramma triangularis</i> ssp. <i>triangularis</i>	Fern, Goldenback	n	p
X <i>Phalaris paradoxa</i>	Canary Grass, Hood	i	a
X <i>Physocarpus capitatus</i>	Ninebark, Pacific	n	p
X <i>Picris echioides</i>	Ox-tongue, Bristly	i	ab
X <i>Pinus radiata</i>	Pine, Monterey	n	p
X <i>Plantago lanceolata</i>	Plantain, English	i	a
X <i>Plantago major</i>	Plantain, Common	i	ap
X <i>Poa annua</i>	Blue Grass, Annual	i	a
X <i>Polygonum arenastrum</i>	Knotweed, Common Yard	n	a
X <i>Polypodium calirhiza</i>	Fern, Polypody	n	p
X <i>Polypogon monspeliensis</i>	Rabbitfoot Grass, Annual	i	a
X <i>Polystichum munitum</i>	Fern, Western Sword	n	p
X <i>Potentilla glandulosa</i> ssp. <i>glandulosa</i>	Cinquefoil, Sticky	n	p
? <i>Prunus</i> sp.	Cherry/Plum	n	p
? <i>Psilocarphus brevissimus</i> var. <i>brevissimus</i>	Woolly Heads, Dwarf	n	a
X <i>Pteridium aquilinum</i> var. <i>pubescens</i>	Fern, Bracken	n	p
X <i>Quercus agrifolia</i> var. <i>agrifolia</i>	Oak, Coast Live	n	p
X <i>Raphanus sativus</i>	Radish, Wild	i	a
X <i>Rhamnus californica</i> ssp. <i>californica</i>	Coffee Berry, California	n	p
X <i>Ribes menziesii</i>	Gooseberry, Canyon	n	p
X <i>Rorippa nasturtium-aquaticum</i>	Water Cress, White	i	p
X <i>Rosa gymnocarpa</i>	Rose, Wood	n	p
X <i>Rubus discolor</i>	Blackberry, Himalayan	i	p
X <i>Rubus parviflorus</i>	Thimbleberry	n	p
X <i>Rubus ursinus</i>	Blackberry, Native California	n	p
X <i>Rumex acetosella</i>	Sheep Sorrel	i	p
X <i>Rumex crispus</i>	Dock, Curly	i	p
X <i>Rumex pulcher</i>	Dock, Fiddle	i	p
X <i>Salix lasiolepis</i>	Willow, Arroyo	n	p
X <i>Sambucus mexicana</i>	Elderberry, Blue	n	p
X <i>Sanicula crassicaulis</i>	Sanicle, Pacific Woodland	n	p
X <i>Scrophularia californica</i> ssp. <i>californica</i>	Figwort, California	n	p
X <i>Senecio vulgaris</i>	Groundsel, Common	i	a
X <i>Silene gallica</i>	Pink, Windmill	i	a
X <i>Silybum marianum</i>	Thistle, Milk	i	ab
X <i>Sisymbrium officinale</i>	Mustard, Hedge	i	a

Plant List - Leona - 5/19/98 and 6/1/98

Scientific Name	Common Name	N/I	L
X <i>Sisyrinchium bellum</i>	Grass, Blue-eyed	n	p
X <i>Smilacina stellata</i>	Solomon's Seal, Starry False	n	p
? <i>Solanum americanum</i>	Nightshade, Small-flower	n	ap
X <i>Soliva sessilis</i>	Soliva, Common	n	a
X <i>Sonchus asper</i> ssp. <i>asper</i>	Sow Thistle, Prickly	i	a
X <i>Spergularia rubra</i>	Sand Spurry, Ruby	i	ap
X <i>Stachys ajugoides</i> var. <i>rigida</i>	Hedge Nettle, Common Rigid	n	p
X <i>Stellaria media</i>	Chickweed, Common	i	a
X <i>Symphoricarpos albus</i> var. <i>laevigatus</i>	Snowberry, Bush / Common	n	p
X <i>Symphoricarpos mollis</i>	Snowberry, Creeping	n	p
X <i>Taraxacum officinale</i>	Dandelion, Common	i	bp
X <i>Thalictrum fendleri</i> var. <i>polycarpum</i>	Meadow Rue, Foothill	n	p
X <i>Toxicodendron diversilobum</i>	Poison Oak	n	p
X <i>Trifolium dubium</i>	Clover, Shamrock	i	a
X <i>Trifolium hirtum</i>	Clover, Rose	i	a
X <i>Trillium chloropetalum</i>	Trillium, Giant	n	p
X <i>Umbellularia californica</i>	Bay Laurel, California	n	p
X <i>Urtica dioica</i> ssp. <i>holosericea</i>	Nettle, Creek Stinging	n	p
X <i>Vaccinium ovatum</i>	Huckleberry, Evergreen	n	p
X <i>Veronica americana</i>	Speedwell, American Brooklime	n	p
X <i>Vicia sativa</i> ssp. <i>sativa</i>	Vetch, Spring	i	a
X <i>Vicia villosa</i> ssp. <i>varia</i>	Vetch, Winter	i	ab
X <i>Vinca major</i>	Periwinkle, Greater	i	p
X <i>Vulpia bromoides</i>	Fescue, Six-weeks	i	a
X <i>Vulpia microstachys</i> var. <i>pauciflora</i>	Fescue, Few-flower	n	a
X <i>Vulpia myuros</i> var. <i>myuros</i>	Fescue, Rattail	n	a
X <i>Zantedeschia aethiopica</i>	Lily, Calla	i	p

California Native Plant Society's
Inventory of Rare and Endangered Vascular Plants of California

CNPS Potential Plants by Scientific Name - Leona Heights
(Plants reported from Oakland East quad)

Scientific/Common Name	CNPS	R-E-D	State	Federal
<i>ARCTOSTAPHYLOS PALLIDA</i> "pallid manzanita"	1B	3-3-3	CE	FT
<i>ASTRAGALUS TENER</i> VAR. <i>TENER</i> "alkali milk-vetch"	1B	3-2-3	None	None
<i>BALSAMORHIZA MACROLEPIS</i> VAR. <i>MACROLEPIS</i> "big-scale balsamroot"	1B	2-2-3	None	None
<i>CHORIZANTHE ROBUSTA</i> VAR. <i>ROBUSTA</i> "robust spineflower"	1B	3-3-3	None	FE
<i>CLARKIA CONCINNA</i> SSP. <i>AUTOMIXA</i> "Santa Clara red ribbons"	1B	2-2-3	None	SOC
<i>CLARKIA FRANCISCANA</i> "Presidio clarkia"	1B	3-3-3	CE	FE
<i>DIRCA OCCIDENTALIS</i> "western leatherwood"	1B	2-2-3	None	None
<i>ERIOGONUM LUTEOLUM</i> VAR. <i>CANINUM</i> "Tiburon buckwheat"	3	?-2-3	None	None
<i>FRITILLARIA LILIACEA</i> "fragrant fritillary"	1B	1-2-3	None	SOC
<i>HELIANTHELLA CASTANEA</i> "Diablo helianthella"	1B	3-2-3	None	SOC
<i>HORKELIA CUNEATA</i> SSP. <i>SERICEA</i> "Kellogg's horkelia"	1B	3-3-3	None	SOC
<i>MONARDELLA VILLOSA</i> SSP. <i>GLOBOSA</i> "robust monardella"	1B	3-2-3	None	None
<i>PLAGIOBOTHRYIS DIFFUSUS</i> "San Francisco popcorn-flower"	1B	3-3-3	CE	SOC
<i>POTAMOGETON FILIFORMIS</i> "slender-leaved pondweed"	2	3-2-1	None	None
<i>STREPTANTHUS ALBIDUS</i> SSP. <i>PERAMOENUS</i> "most beautiful jewel-flower"	1B	2-2-3	None	SOC

Potential CNPS Listed Plants at Leona Heights
(reported from Oakland East quad)

ARCTOSTAPHYLOS PALLIDA
"pallid manzanita"

Family: Ericaceae

Life Form: Shrub (evergreen) **Blooms:** December-March
CNPS List: [1B] R/T/E in CA and elsewhere **R-E-D:** 3-3-3
State: [CE] State listed as Endangered (11/79) **Stat.Rpt:** 1987
Federal: [FT] Federally listed as Threatened (04/22/98)
Counties: Alameda, Contra Costa
Quads: Oakland East (465C), Richmond (466A)
Habitat: Broadleaved upland forest, Closed-cone coniferous forest, Chaparral, Cismontane woodland, Coastal scrub / siliceous shale, sandy or gravelly
Elevation: 185-465 m.
Notes: Known from thirteen occurrences in the Contra Costa Hills of the Diablo Range. Threatened by alteration of fire regimes, non-native plants, and road construction, and possibly by development, fungal infection, and hybridization. Plants from 465B are introduced. See Leaflets of Western Botany 1:76 (1933) for original description, and Four Seasons 7(4):28-46 (1987) for ecological assessment.

ASTRAGALUS TENER VAR. *TENER*
"alkali milk-vetch"

Family: Fabaceae

Life Form: Annual herb **Blooms:** March-June
CNPS List: [1B] R/T/E in CA and elsewhere **R-E-D:** 3-2-3
State: [None] No state status
Federal: [None] No federal status
Counties: Alameda [extirpated], Contra Costa [extirpated], Merced, Monterey [extirpated], Napa, San Benito [extirpated], Santa Clara [extirpated], San Francisco [extirpated], San Joaquin [extirpated], Solano, Sonoma [extirpated], Stanislaus [extirpated], Yolo
Quads: Salinas (365B) [extirpated], San Felipe (385B) [extirpated], Hollister (385C) [extirpated], San Luis Ranch (403A), Hatch (423B) [extirpated], Gustine (423C), Stevinson (423D), Crows Landing (424A) [extirpated], Milpitas (427B) [extirpated], Mountain View (428A) [extirpated], Altamont (445B) [extirpated], Hayward (447A) [extirpated], San Leandro (447B) [extirpated], Newark (447D) [extirpated], Stockton West (462A) [extirpated], Byron Hot Springs (463C) [extirpated], Walnut Creek (465A) [extirpated], Oakland East (465C) [extirpated], Richmond (466A) [extirpated], San Francisco North (466C) [extirpated], Oakland West (466D) [extirpated], Denverton (481B), Antioch North (481D), Fairfield South (482A), Cuttings Wharf (483A), Petaluma (484B) [extirpated], Saxon (497B), Dixon (498A) [extirpated], Elmira (498C), Dozier (498D), Fairfield North (499D) [extirpated], Napa (500D) [extirpated], Grays Bend (513B), Davis (513C), Woodland (514A) [extirpated], Merritt (514D) [extirpated]
Habitat: Playas, Valley and foothill grassland (adobe clay), Vernal pools / alkaline
Elevation: 1-60 m.
Notes: Last Bay Area collection in 1959. Threatened by habitat destruction, especially agricultural conversion, and protected only at Jepson Prairie Preserve, SOL Co. See Proceedings of the American Academy of Arts and Sciences 6:206 (1864) for original description, and Systematic Botany 17(3):367-379 (1992) for distributional information.

Potential CNPS Listed Plants at Leona Heights
(reported from Oakland East quad)

BALSAMORHIZA MACROLEPIS VAR. *MACROLEPIS*
"big-scale balsamroot"

Family: Asteraceae

Life Form: Perennial herb
CNPS List: [1B] R/T/E in CA and elsewhere
State: [None] No state status
Federal: [None] No federal status
Counties: Alameda, Butte, Colusa, Lake, Mariposa, Napa, Placer, Santa Clara, Solano, Tehama
Quads: Gilroy (406D), El Capitan (437B), Buckingham Mtn. (438D), Altamont (445B), Livermore (446A), Hayward (447A), Oakland East (465C), Cordelia (482B), Mt. George (499C), Pilot Hill (527D), Lincoln (528A), Roseville (528D), Wilbur Springs (547C), Hough Springs (548A), Brush Creek (575A), Riley Ridge (596B), Devils Parade Ground (608C), Ono 15' SE (630D)
Habitat: Chaparral, Cismontane woodland, Valley and foothill grassland / sometimes serpentinite
Elevation: 90-1,400 m.
Notes: See Annals of the Missouri Botanical Garden 22:132 (1935) for original description.

CHORIZANTHE ROBUSTA VAR. *ROBUSTA*
"robust spineflower"

Family: Polygonaceae

Life Form: Annual herb
CNPS List: [1B] R/T/E in CA and elsewhere
State: [None] No state status
Federal: [FE] Federally listed as Endangered (02/04/94)
Counties: Alameda [extirpated], Monterey, Santa Clara [extirpated], Santa Cruz, San Mateo [extirpated]
Quads: Espinosa Canyon (318D) [extirpated], Soledad (342A) [extirpated], Marina (366A), Seaside (366D) [extirpated], Watsonville East (386B) [possibly extirpated], Watsonville West (387A), Soquel (387B), Moss Landing (387D), Los Gatos (407B) [extirpated], Laurel (407C) [extirpated], Felton (408D) [possibly extirpated], San Jose West (427C) [extirpated], San Francisco South (448B) [extirpated], Oakland East (465C) [extirpated]
Habitat: Cismontane woodland (openings), Coastal dunes, Coastal scrub / sandy or gravelly
Elevation: 3-300 m.
Notes: Most populations extirpated and now known from only four extended occurrences. Threatened by development, recreation, mining, and non-native plants. See *C. robusta* in The Jepson Manual. See Phytologia 66(2):130-131 (1989) for taxonomic treatment, and Fremontia 24(4):8-11 (1996) for taxonomic discussion.

California Native Plant Society's
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Potential CNPS Listed Plants at Leona Heights
(reported from Oakland East quad)

CLARKIA CONCINNA SSP. *AUTOMIXA*
"Santa Clara red ribbons"

Family: Onagraceae

Life Form: Annual herb
CNPS List: [1B] R/T/E in CA and elsewhere
State: [None] No state status
Federal: [SOC] Species of Concern
Counties: Alameda, Santa Clara
Quads: Mississippi Creek (405B), Mt. Sizer (406A), Los Gatos (407B), Loma Prieta (407D), Castle Rock Ridge (408A), Mt. Day (426B), Lick Observatory (426C), Isabel Valley (426D), Calaveras Reservoir (427A), San Jose East (427D), Palo Alto (428B), Mindego Hill (428C), Cupertino (428D), Cedar Mtn. (445D), Niles (446C), Oakland East (465C)
Habitat: Chaparral, Cismontane woodland
Elevation: 90-1,500 m.
Notes: See Madrono 34(1):41-47 (1987) for original description.

CLARKIA FRANCISCANA
"Presidio clarkia"

Family: Onagraceae

Life Form: Annual herb
CNPS List: [1B] R/T/E in CA and elsewhere
State: [CE] State listed as Endangered (11/78)
Federal: [FE] Federally listed as Endangered (02/03/95)
Counties: Alameda, San Francisco
Quads: Oakland East (465C), San Francisco North (466C)
Habitat: Coastal scrub, Valley and foothill grassland (serpentinite)
Elevation: 25-335 m.
Notes: Known from fewer than five occurrences. Threatened by Army activities, vehicles, urbanization and non-native plants. See Brittonia 10:7-13 (1958) for original description, and Madrono 39(1):1-7 (1992) for information on ALA Co. occurrence.

DIRCA OCCIDENTALIS
"western leatherwood"

Family: Thymelaeaceae

Life Form: Shrub (deciduous)
CNPS List: [1B] R/T/E in CA and elsewhere
State: [None] No state status
Federal: [None] No federal status
Counties: Alameda, Contra Costa, Marin, Santa Clara, San Mateo, Sonoma
Quads: Mountain View (428A), Palo Alto (428B), Mindego Hill (428C), Woodside (429A), La Honda (429D), Hayward (447A), Montara Mountain (448C), Diablo (464C), Briones Valley (465B), Oakland East (465C), Las Trampas Ridge (465D), Richmond (466A), Bolinas (467B), Benicia (482C), San Geronimo (484C), Inverness (485D), Valley Ford (502C), Bodega Head (503D)
Habitat: Broadleaved upland forest, Closed-cone coniferous forest, Chaparral, Cismontane woodland, North Coast coniferous forest, Riparian forest, Riparian woodland / mesic
Elevation: 50-395 m.
Notes: Populations declining; not reproducing well.

Potential CNPS Listed Plants at Leona Heights
(reported from Oakland East quad)

ERIOGONUM LUTEOLUM VAR. *CANINUM*

"Tiburon buckwheat"

Family: Polygonaceae

Life Form: Annual herb **Blooms:** June-September
CNPS List: [3] More information is needed. **R-E-D:** ?-2-3
State: [None] No state status **Stat.Rpt:** 1977
Federal: [None] No federal status
Counties: Alameda, Colusa, Lake, Marin, Napa, Santa Clara, San Mateo, Sonoma
[extirpated]
Quads: Santa Teresa Hills (407A), Montara Mountain (448C), Oakland East (465C),
San Quentin (466B), San Francisco North (466C), San Rafael (467A), Bolinas
(467B), Point Bonita (467D), Petaluma (484B), San Geronimo (484C), Capell
Valley (499B), Mt. George (499C), Camp Meeker (502B) [extirpated], Walter
Springs (516A), Detert Reservoir (517A), Mount St. Helena (517B) [possibly
extirpated], Lucerne (549D)
Habitat: Chaparral, Coastal prairie, Valley and foothill grassland / serpentinite
Elevation: 10-500 m.
Notes: Move to List 1B? Location information needed, especially quads for COL
Co. Not clearly distinguishable from var. *luteolum*; *E. luteolum* is
similar to *E. gracile* to the south, and *E. vimineum* to the northeast.
Threatened by development and non-native plants. Protected in part at
Ring Mtn. Preserve, MRN Co. See *Flora Franciscana*, pp. 150-151 (1891) by
E. Greene for original description, and *Phytologia* 66(4):378-379 (1989)
for alternative treatment which restricts var. *caninum* to ALA and MRN
counties.

FRITILLARIA LILIACEA

"fragrant fritillary"

Family: Liliaceae

Life Form: Perennial herb (bulbiferous) **Blooms:** February-April
CNPS List: [1B] R/T/E in CA and elsewhere **R-E-D:** 1-2-3
State: [None] No state status **Stat.Rpt:** 1979
Federal: [SOC] Species of Concern
Counties: Alameda, Contra Costa, Monterey, Marin, San Benito, Santa Clara, San
Francisco, San Mateo, Solano, Sonoma
Quads: Monterey (366C) [extirpated], Watsonville East (386B), Morgan Hill (406B),
Santa Teresa Hills (407A), Los Gatos (407B), San Jose East (427D),
Woodside (429A), San Gregorio (429C), Hayward (447A), Montara Mountain
(448C), San Mateo (448D), Clayton (464B), Oakland East (465C), Richmond
(466A) [extirpated], Antioch North (481D), Petaluma River (484A), San
Geronimo (484C), Novato (484D), Point Reyes NE (485A), Tomales (485B),
Drakes Bay (485C), Inverness (485D), Dozier (498D), Kenwood (501A), Santa
Rosa (501B), Cotati (501C) [extirpated], Camp Meeker (502B)
Habitat: Coastal prairie, Coastal scrub, Valley and foothill grassland / often
serpentinite
Elevation: 3-410 m.
Notes: Threatened by grazing and loss of habitat to agriculture and urbanization.
Quite variable.

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Potential CNPS Listed Plants at Leona Heights
(reported from Oakland East quad)

HELIANTHELLA CASTANEA
"Diablo helianthella"

Family: Asteraceae

Life Form: Perennial herb
CNPS List: [1B] R/T/E in CA and elsewhere
State: [None] No state status
Federal: [SOC] Species of Concern
Counties: Alameda, Contra Costa, Marin [extirpated], San Francisco [extirpated], San Mateo
Quads: Cedar Mtn. (445D), Dublin (446B), Hayward (447A), San Francisco South (448B), Byron Hot Springs (463C), Antioch South (464A), Clayton (464B), Diablo (464C), Tassajara (464D), Walnut Creek (465A), Briones Valley (465B), Oakland East (465C) [extirpated], Las Trampas Ridge (465D), Richmond (466A), San Rafael (467A) [extirpated], Benicia (482C), Mare Island (483D)
Habitat: Broadleaved upland forest, Chaparral, Cismontane woodland, Coastal scrub, Riparian woodland, Valley and foothill grassland
Elevation: 60-1,300 m.
Notes: Threatened by urbanization, grazing, and fire suppression.

HORKELIA CUNEATA SSP. SERICEA
"Kellogg's horkelia"

Family: Rosaceae

Life Form: Perennial herb
CNPS List: [1B] R/T/E in CA and elsewhere
State: [None] No state status
Federal: [SOC] Species of Concern
Counties: Alameda [extirpated], Marin [extirpated], Monterey, Santa Barbara, Santa Cruz, San Francisco [extirpated], San Luis Obispo, San Mateo
Quads: Lompoc (170B) [extirpated], Surf (171A), Tranquillon Mtn. (171D), Guadalupe (196A) [extirpated], Point Sal (196B) [extirpated], Casmalia (196D) [extirpated], Nipomo (220C), Oceano (221D), Morro Bay South (247D) [extirpated], Cambria (271D), San Miguel (293C), Salinas (365B), Spreckels (365C), Marina (366A), Monterey (366C) [extirpated], Seaside (366D), Prunedale (386C) [extirpated], Soquel (387B) [extirpated], Davenport (408C), Felton (408D), Ano Nuevo (409D), San Francisco South (448B), Oakland East (465C) [extirpated], San Francisco North (466C) [extirpated], Oakland West (466D) [extirpated], Point Bonita (467D) [extirpated], Drakes Bay (485C) [extirpated]
Habitat: Closed-cone coniferous forest, Chaparral (maritime), Coastal scrub / sandy or gravelly, openings
Elevation: 10-200 m.
Notes: Historical occurrences need field surveys. Threatened by coastal development. Occurrence from the Crocker Hills probably last remaining location in S.F. Bay. Remaining plants less distinct from ssp. cuneata than those formerly occurring near San Francisco.

Potential CNPS Listed Plants at Leona Heights
(reported from Oakland East quad)

MONARDELLA VILLOSA SSP. *GLOBOSA*
"robust monardella"

Family: Lamiaceae

Life Form: Perennial herb (rhizomatous) **Blooms:** June-July
CNPS List: [1B] R/T/E in CA and elsewhere **R-E-D:** 3-2-3
State: [None] No state status
Federal: [None] No federal status
Counties: Alameda, Contra Costa, Humboldt, Lake, Marin, Napa, San Mateo, Sonoma
Quads: Mindogo Hill (428C), Niles (446C), Briones Valley (465B), Oakland East (465C), Benicia (482C), Vine Hill (482D), Fairfield North (499D), Bodega Head (503D), Healdsburg (518D), Weott (635C)
Habitat: Chaparral (openings), Cismontane woodland
Elevation: 185-600 m.
Notes: Known from approximately ten occurrences. Need quads for LAK and MRN counties. See Pittonia 5:82 (1902) for original description, and Phytologia 72(1):9-16 (1992) for revised nomenclature.

PLAGIOBOTHRYIS DIFFUSUS
"San Francisco popcorn-flower"

Family: Boraginaceae

Life Form: Annual herb **Blooms:** April-June
CNPS List: [1B] R/T/E in CA and elsewhere **R-E-D:** 3-3-3
State: [CE] State listed as Endangered (09/79) **Stat.Rpt:** 1988
Federal: [SOC] Species of Concern
Counties: Alameda, Santa Cruz, San Francisco [extirpated]
Quads: Soquel (387B), Santa Cruz (387E), Laurel (407C), Felton (408D), Oakland East (465C), San Francisco North (466C) [extirpated]
Habitat: Coastal prairie, Valley and foothill grassland
Elevation: 60-360 m.
Notes: Known from fewer than 10 occurrences. Threatened by development and non-native plants. Identification difficult; taxonomic work needed. See *P. reticulatus* var. *rossianorum* in The Jepson Manual. See Pittonia 1:14 (1887) for original description, and Contributions from the Arnold Arboretum 3:77 (1932) for revised nomenclature.

POTAMOGETON FILIFORMIS
"slender-leaved pondweed"

Family: Potamogetonaceae

Life Form: Perennial herb (rhizomatous), aquatic **Blooms:** May-July
CNPS List: [2] R/T/E in CA, but more common elsewhere **R-E-D:** 3-2-1
State: [None] No state status
Federal: [None] No federal status
Counties: Contra Costa, Lassen, Merced, Mono, Santa Clara [extirpated], Sierra, Arizona, Nevada, Oregon, Washington, widespread outside of California
Quads: Ingomar (403B), Mountain View (428A) [extirpated], Palo Alto (428B) [extirpated], June Lake (453D), Oakland East (465C), Sierra City (572C), Gallatin Peak (640C)
Habitat: Marshes and Swamps (assorted shallow freshwater)
Elevation: 300-2,150 m.
Notes: To be expected in the San Joaquin Valley, San Francisco Bay area, and the central high Sierra Nevada; need information. On review list in OR.

Potential CNPS Listed Plants at Leona Heights
(reported from Oakland East quad)

STREPTANTHUS ALBIDUS SSP. *PERAMOENUS*
"most beautiful jewel-flower"

Family: Brassicaceae

Life Form: Annual herb
CNPS List: [1B] R/T/E in CA and elsewhere
State: [None] No state status
Federal: [SOC] Species of Concern
Counties: Alameda, Contra Costa, Santa Clara
Quads: Chittenden (386A), Mt. Sizer (406A), Morgan Hill (406B), Gilroy (406D), Santa Teresa Hills (407A), Los Gatos (407B), Niles (446C), La Costa Valley (446D), Clayton (464B), Diablo (464C) [?], Briones Valley (465B), Oakland East (465C), Las Trampas Ridge (465D), Richmond (466A)
Habitat: Chaparral, Cismontane woodland, Valley and foothill grassland / serpentinite
Elevation: 120-730 m.
Notes: Historical occurrences need field surveys. Threatened by development and grazing. Similar plants from MNT and SLO counties are likely *S. glandulosus* ssp. *glandulosus*, but further study needed.

Appendix B: WILDLIFE LIST

RESOURCE INVENTORY CHECKLIST: WILDLIFE: LEONA HEIGHTS

CLASS	COMMONNAME	LATIN NAME	OBS	EXP	BREEDING
Amphibians	Arboreal Salamander	<i>Aneides lugubris</i>		X	X
Amphibians	Bullfrog	<i>Rana catesbiana</i>			
Amphibians	California Newt, Coast Range	<i>Taricha torosa</i>		X	X
Amphibians	California Slender Salamander	<i>Batrachoseps attenuatus</i>		X	X
Amphibians	Ensatina, Yellow-eyed	<i>Ensatina eschscholtzi</i>		X	X
Amphibians	Foothill Yellow-legged Frog	<i>Rana boylei</i>			
Amphibians	Pacific Treefrog	<i>Hyla regilla</i>	X		X
Amphibians	Red-legged Frog, California	<i>Rana aurora draytonii</i>			
Amphibians	Rough-skinned Newt, Northern	<i>Taricha granulosa</i>		X	X
Amphibians	Tiger Salamander, California	<i>Ambystoma tigrinum californiense</i>			
Amphibians	Western Spadefoot Toad	<i>Scaphiopus hammondi</i>			
Amphibians	Western Toad, California	<i>Bufo boreas</i>		X	X
Birds	Acorn Woodpecker	<i>Melanerpes formicivorus</i>	X		X
Birds	Allen's Hummingbird	<i>Selasphorus sasin</i>	X		X
Birds	American Avocet	<i>Recurvirostra americana</i>			
Birds	American Bittern	<i>Botaurus lentiginosus</i>			
Birds	American Coot	<i>Fulica americana</i>			
Birds	American Crow	<i>Corvus brachyrhynchos</i>	X		
Birds	American Dipper	<i>Cinclus mexicanus</i>			
Birds	American Goldfinch	<i>Carduelis tristis</i>		X	X
Birds	American Green-winged Teal	<i>Anas crecca</i>			
Birds	American Kestrel	<i>Falco sparverius</i>		X	X
Birds	American Robin	<i>Turdus migratorius</i>		X	X
Birds	American White Pelican	<i>Pelecanus erythrorhynchos</i>			
Birds	American Wigeon	<i>Anas americana</i>			
Birds	Anna's Hummingbird	<i>Calypte anna</i>	X		X
Birds	Arctic Loon	<i>Gavia arctica</i>			
Birds	Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>			
Birds	Baird's Sandpiper	<i>Calidris bairdii</i>			
Birds	Bald Eagle	<i>Haliaeetus leucocephalus</i>			
Birds	Band-tailed Pigeon	<i>Columba fasciata</i>		X	X
Birds	Bank Swallow	<i>Riparia riparia</i>			
Birds	Barn Swallow	<i>Hirundo rustica</i>		X	
Birds	Barrow's Goldeneye	<i>Bucephala islandica</i>			
Birds	Belted Kingfisher	<i>Ceryle alcyon</i>		X	
Birds	Bewick's Wren	<i>Thryomanes bewickii</i>	X		X
Birds	Black Phoebe	<i>Sayornis nigricans</i>		X	X
Birds	Black Scoter	<i>Melanitta nigra</i>			
Birds	Black Tern	<i>Chlidonias niger</i>			
Birds	Black Turnstone	<i>Arenaria melanocephala</i>			
Birds	Black-bellied Plover	<i>Pluvialis squatarola</i>			
Birds	Black-chinned Hummingbird	<i>Archilochus alexandri</i>			
Birds	Black-chinned Sparrow	<i>Spizella atrogularis</i>			
Birds	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>			
Birds	Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>		X	X
Birds	Black-necked Stilt	<i>Himantopus mexicanus</i>			
Birds	Black-throated Gray Warbler	<i>Dendroica nigrescens</i>	X		
Birds	Blue Grosbeak	<i>Guiraca caerulea</i>			
Birds	Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>		X	
Birds	Blue-winged Teal	<i>Anas discors</i>			
Birds	Bonaparte's Gull	<i>Larus philadelphia</i>			
Birds	Brandt's Cormorant	<i>Phalacrocorax penicillatus</i>			
Birds	Brewer's Blackbird	<i>Euphagus cyanocephalus</i>		X	
Birds	Brown Creeper	<i>Certhia americana</i>	X		X
Birds	Brown Pelican	<i>Pelecanus occidentalis</i>			
Birds	Brown Towhee	<i>Pipilo fuscus</i>	X		X
Birds	Brown-headed Cowbird	<i>Molothrus ater</i>		X	
Birds	Bufflehead	<i>Bucephala albeola</i>			
Birds	Burrowing Owl	<i>Athene (Speotyto) cunicularia</i>			
Birds	Bushtit	<i>Psaltiriparus minimus</i>		X	X
Birds	California Black Rail	<i>Laterallus jamaicensis coturniculus</i>			
Birds	California Clapper Rail	<i>Rallus longirostris obsoletus</i>			
Birds	California Gull	<i>Larus californicus</i>			
Birds	California Quail	<i>Callipepla californica</i>		X	X
Birds	California Thrasher	<i>Toxostoma redivivum</i>	X		X
Birds	Calliope Hummingbird	<i>Stellula calliope</i>			
Birds	Canada Goose	<i>Branta canadensis</i>			
Birds	Canvasback	<i>Aythya valisineria</i>			
Birds	Canyon Wren	<i>Catherpes mexicanus</i>			
Birds	Caspian Tern	<i>Sterna caspia</i>			
Birds	Cattle Egret	<i>Bubulcus ibis</i>			
Birds	Cedar Waxwing	<i>Bombycilla cedrorum</i>		X	
Birds	Chestnut-backed Chickadee	<i>Parus rufescens</i>	X		X
NOTE: OBS = OBSERVED, EXP = EXPECTED					

CLASS	COMMONNAME	LATIN NAME	OBS	EXP	BREEDING
Birds	Chipping Sparrow	<i>Spizella passerina</i>			
Birds	Cinnamon Teal	<i>Anas cyanoptera</i>			
Birds	Cliff Swallow	<i>Hirundo pyrrhonota</i>		X	
Birds	Common Barn Owl	<i>Tyto alba</i>		X	
Birds	Common Goldeneye	<i>Bucephala clangula</i>			
Birds	Common Loon	<i>Gavia immer</i>			
Birds	Common Merganser	<i>Mergus merganser</i>			
Birds	Common Moorhen (Gallinule)	<i>Gallinula chloropus</i>			
Birds	Common Murre	<i>Uria aalge</i>			
Birds	Common Poorwill	<i>Phalaenoptilus nuttallii</i>			
Birds	Common Raven	<i>Corvus corax</i>	X		
Birds	Common Snipe	<i>Gallinago gallinago</i>			
Birds	Common Tern	<i>Sterna hirundo</i>			
Birds	Common Yellowthroat	<i>Geothlypis trichas</i>		X	X
Birds	Cooper's Hawk	<i>Accipiter cooperii</i>	X		X
Birds	Dark-eyed (Oregon) Junco	<i>Junco hyemalis</i>	X		
Birds	Dark-eyed (Slate-colored) Junco	<i>Junco hyemalis</i>	X		
Birds	Double-crested Cormorant	<i>Phalacrocorax auritus</i>			
Birds	Downy Woodpecker	<i>Picoides pubescens</i>		X	
Birds	Dunlin	<i>Calidris alpina</i>			
Birds	Dusky Flycatcher	<i>Empidonax oberholseri</i>			
Birds	Eared Grebe	<i>Podiceps nigricollis</i>			
Birds	Elegant Tern	<i>Sterna elegans</i>			
Birds	Eurasian Wigeon	<i>Anas penelope</i>			
Birds	European Starling	<i>Sturnus vulgaris</i>		X	X
Birds	Ferruginous Hawk	<i>Buteo regalis</i>			
Birds	Forster's Tern	<i>Sterna forsteri</i>			
Birds	Fox Sparrow	<i>Passerella iliaca</i>	X		
Birds	Gadwall	<i>Anas strepera</i>			
Birds	Glaucous Gull	<i>Larus hyperboreus</i>			
Birds	Glaucous-winged Gull	<i>Larus glaucescens</i>			
Birds	Golden Eagle	<i>Aquila chrysaetos</i>			
Birds	Golden-crowned Kinglet	<i>Regulus satrapa</i>	X		
Birds	Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	X		
Birds	Grasshopper Sparrow	<i>Ammodramus savannarum</i>			
Birds	Great Blue Heron	<i>Ardea herodias</i>			
Birds	Great Egret	<i>Casmerodius albus</i>			
Birds	Great Horned Owl	<i>Bubo virginianus</i>		X	X
Birds	Greater Roadrunner	<i>Geococcyx californianus</i>			
Birds	Greater Scaup	<i>Aythya marila</i>			
Birds	Greater White-fronted Goose	<i>Anser albifrons</i>			
Birds	Greater Yellowlegs	<i>Tringa melanoleuca</i>			
Birds	Green-backed Heron	<i>Butorides striatus</i>		X	
Birds	Hairy Woodpecker	<i>Picoides villosus</i>	X		
Birds	Hammond's Flycatcher	<i>Empidonax hammondii</i>			
Birds	Heermann's Gull	<i>Larus heermanni</i>			
Birds	Hermit Thrush	<i>Catharus guttatus</i>	X		
Birds	Hermit Warbler	<i>Dendroica occidentalis</i>			
Birds	Herring Gull	<i>Larus argentatus</i>			
Birds	Hooded Merganser	<i>Lophodytes cucullatus</i>			
Birds	Hooded Oriole	<i>Icterus cucullatus</i>			
Birds	Horned Grebe	<i>Podiceps auritus</i>			
Birds	Horned Lark	<i>Eremophila alpestris</i>			
Birds	House Finch	<i>Carpodacus mexicanus</i>		X	X
Birds	House Sparrow	<i>Passer domesticus</i>		X	X
Birds	House Wren	<i>Troglodytes aedon</i>		X	X
Birds	Hutton's Vireo	<i>Vireo huttoni</i>	X		X
Birds	Killdeer	<i>Charadrius vociferus</i>			
Birds	Lark Sparrow	<i>Chondestes grammacus</i>			
Birds	Lawrence's Goldfinch	<i>Carduelis lawrencei</i>		X	
Birds	Lazuli Bunting	<i>Passerina amoena</i>		X	
Birds	Least Sandpiper	<i>Calidris minutilla</i>			
Birds	Least Tern	<i>Sterna antillarum browni</i>			
Birds	Lesser Golden-Plover	<i>Pluvialis dominica</i>			
Birds	Lesser Goldfinch	<i>Carduelis psaltria</i>		X	
Birds	Lesser Scaup	<i>Aythya affinis</i>			
Birds	Lesser Yellowlegs	<i>Tringa flavipes</i>			
Birds	Lewis' Woodpecker	<i>Melanerpes lewis</i>			
Birds	Lincoln's Sparrow	<i>Melospiza lincolni</i>		X	
Birds	Loggerhead Shrike	<i>Lanius ludovicianus</i>		X	X
Birds	Long-billed Curlew	<i>Numenius americanus</i>			
Birds	Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>			
Birds	MacGillivray's Warbler	<i>Oporornis tolmiei</i>			
NOTE: OBS = OBSERVED, EXP = EXPECTED					

RESOURCE INVENTORY CHECKLIST:WILDLIFE: LEONA HEIGHTS

CLASS	COMMONNAME	LATIN NAME	OBS	EXP	BREEDING
Birds	Mallard	<i>Anas platyrhynchos</i>	X		X
Birds	Marbled Godwit	<i>Limosa fedoa</i>			
Birds	Marsh Wren	<i>Cistothorus palustris</i>		X	
Birds	Merlin	<i>Falco columbarius</i>		X	
Birds	Mew Gull	<i>Larus canus</i>			
Birds	Mountain Bluebird	<i>Sialia currucoides</i>			
Birds	Mourning Dove	<i>Zenaida macroura</i>	X		X
Birds	Nashville Warbler	<i>Vermivora ruficapilla</i>			
Birds	Northern (Bullock's) Oriole	<i>Icterus galbula</i>		X	X
Birds	Northern Flicker	<i>Colaptes auratus</i>	X		X
Birds	Northern Harrier	<i>Circus cyaneus</i>		X	
Birds	Northern Mockingbird	<i>Mimus polyglottos</i>		X	X
Birds	Northern Pintail	<i>Anas acuta</i>			
Birds	Northern Pygmy-Owl	<i>Glaucidium gnoma</i>			
Birds	Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	X		
Birds	Northern Saw-whet Owl	<i>Aegolius acadicus</i>			
Birds	Northern Shoveler	<i>Anas clypeata</i>			
Birds	Nuttall's Woodpecker	<i>Picoides nuttallii</i>	X		X
Birds	Oldsquaw	<i>Clangula hyemalis</i>			
Birds	Olive-sided Flycatcher	<i>Contopus borealis</i>		X	X
Birds	Orange-crowned Warbler	<i>Vermivora celata</i>		X	X
Birds	Osprey	<i>Pandion haliaetus</i>			
Birds	Parasitic Jaeger	<i>Stercorarius parasiticus</i>			
Birds	Pectoral Sandpiper	<i>Calidris melanotos</i>			
Birds	Pelagic Cormorant	<i>Phalacrocorax pelagicus</i>			
Birds	Peregrine Falcon	<i>Falco peregrinus</i>			
Birds	Phainopepla	<i>Phainopepla nitens</i>			
Birds	Pied-billed Grebe	<i>Podilymbus podiceps</i>			
Birds	Pine Siskin	<i>Carduelis pinus</i>		X	
Birds	Plain Titmouse	<i>Parus inornatus</i>		X	
Birds	Prairie Falcon	<i>Falco mexicanus</i>			
Birds	Purple Finch	<i>Carpodacus purpureus</i>	X		X
Birds	Red Knot	<i>Calidris canutus</i>			
Birds	Red-breasted Merganser	<i>Mergus serrator</i>			
Birds	Red-breasted Nuthatch	<i>Sitta canadensis</i>		X	X
Birds	Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>		X	X
Birds	Red-necked Grebe	<i>Podiceps grisegena</i>			
Birds	Red-necked Phalarope	<i>Phalaropus lobatus</i>			
Birds	Red-shouldered Hawk	<i>Buteo lineatus</i>		X	X
Birds	Red-tailed Hawk	<i>Buteo jamaicensis</i>	X		X
Birds	Red-throated Loon	<i>Gavia stellata</i>			
Birds	Red-winged Blackbird	<i>Agelaius phoeniceus</i>	X		X
Birds	Redhead	<i>Aythya americana</i>			
Birds	Ring-billed Gull	<i>Larus delawarensis</i>			
Birds	Ring-necked Duck	<i>Aythya collaris</i>			
Birds	Ring-necked Pheasant	<i>Phasianus colchicus</i>			
Birds	Rock Dove (Domestic Pigeon)	<i>Columba livia</i>		X	
Birds	Rock Wren	<i>Salpinctes obsoletus</i>			
Birds	Ross' Goose	<i>Chen rossii</i>			
Birds	Rough-legged Hawk	<i>Buteo lagopus</i>			
Birds	Ruby-crowned Kinglet	<i>Regulus calendula</i>	X		
Birds	Ruddy Duck	<i>Oxyura jamaicensis</i>			
Birds	Ruddy Turnstone	<i>Arenaria interpres</i>			
Birds	Rufous Hummingbird	<i>Selasphorus rufus</i>			
Birds	Rufous-crowned Sparrow	<i>Aimophila ruficeps</i>			
Birds	Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>	X		X
Birds	Sage Sparrow	<i>Amphispiza belli</i>			
Birds	Sanderling	<i>Calidris alba</i>			
Birds	Sandhill Crane	<i>Grus canadensis</i>			
Birds	Savannah Sparrow	<i>Passerculus sandwichensis</i>		X	
Birds	Saltmarsh Common Yellowthroat	<i>Geothlypis trichas sinuosa</i>			
Birds	Say's Phoebe	<i>Sayornis saya</i>		X	
Birds	Scrub Jay	<i>Aphelocoma coerulescens</i>	X		X
Birds	Semipalmated Plover	<i>Charadrius semipalmatus</i>			
Birds	Sharp-shinned Hawk	<i>Accipiter striatus</i>	X		
Birds	Short-billed Dowitcher	<i>Limnodromus griseus</i>			
Birds	Short-eared Owl	<i>Asio flammeus</i>			
Birds	Snow Goose	<i>Chen caerulescens</i>			
Birds	Snowy Egret	<i>Egretta thula</i>			
Birds	Snowy Plover	<i>Charadrius alexandrinus nivosus</i>			
Birds	Solitary Vireo	<i>Vireo solitarius</i>	X		
Birds	Song Sparrow	<i>Melospiza melodia</i>	X		X
Birds	Sora	<i>Porzana carolina</i>			
Birds	Spotted Sandpiper	<i>Actitis macularia</i>			
NOTE: OBS = OBSERVED, EXP = EXPECTED					

RESOURCE INVENTORY CHECKLIST: WILDLIFE: LEONA HEIGHTS

CLASS	COMMONNAME	LATIN NAME	OBS	EXP	BREEDING
Birds	Stellar's Jay	<i>Cyanocitta stelleri</i>	X		X
Birds	Suisun Song Sparrow	<i>Melospiza melodia</i>			
Birds	Surf Scoter	<i>Melanitta perspicillata</i>			
Birds	Surfbird	<i>Aphriza virgata</i>			
Birds	Swainson's Thrush	<i>Catharus ustulatus</i>		X	
Birds	Thayer's Gull	<i>Larus thayeri</i>			
Birds	Townsend's Solitaire	<i>Myadestes townsendi</i>			
Birds	Townsend's Warbler	<i>Dendroica townsendi</i>	X		
Birds	Tree Swallow	<i>Tachycineta bicolor</i>		X	
Birds	Tricolored Blackbird	<i>Agelaius tricolor</i>			
Birds	Tundra (Whistling) Swan	<i>Cygnus columbianus</i>			
Birds	Turkey Vulture	<i>Cathartes aura</i>	X		
Birds	Varied Thrush	<i>Ixoreus naevius</i>		X	
Birds	Vaux's Swift	<i>Chaetura vauxi</i>			
Birds	Violet-green Swallow	<i>Tachycineta thalassina</i>		X	
Birds	Virginia Rail	<i>Rallus limicola</i>			
Birds	Wandering Tattler	<i>Heteroscelus incanus</i>			
Birds	Warbling Vireo	<i>Vireo gilvus</i>		X	X
Birds	Water Pipet	<i>Anthus spinoletta</i>		X	
Birds	Western Bluebird	<i>Sialia mexicana</i>		X	
Birds	Western Flycatcher	<i>Empidonax difficilis</i>		X	X
Birds	Western Grebe	<i>Aechmophorus occidentalis</i>			
Birds	Western Gull	<i>Larus occidentalis</i>			
Birds	Western Kingbird	<i>Tyrannus verticalis</i>		X	
Birds	Western Meadowlark	<i>Sturnella neglecta</i>		X	
Birds	Western Sandpiper	<i>Calidris mauri</i>			
Birds	Western Screech-Owl	<i>Otus kennicottii</i>		X	X
Birds	Western Tanager	<i>Piranga ludoviciana</i>		X	
Birds	Western Wood-Pewee	<i>Contopus sordidulus</i>		X	
Birds	Western Yellow-billed Cuckoo	<i>Coccyzus americanus occidentalis</i>			
Birds	Whimbrel	<i>Numenius phaeopus</i>			
Birds	White-breasted Nuthatch	<i>Sitta carolinensis</i>		X	X
Birds	White-crowned Sparrow	<i>Zonotrichia leucophrys</i>		X	X
Birds	White-throated Sparrow	<i>Zonotrichia albicollis</i>			
Birds	White-throated Swift	<i>Aeronautes saxatalis</i>			
Birds	White-tailed Kite	<i>Elanus leucurus</i>			
Birds	Wild Turkey	<i>Meleagris gallopavo</i>			
Birds	Willet	<i>Catoptrophorus semipalmatus</i>			
Birds	Willow Flycatcher	<i>Empidonax traillii</i>			
Birds	Wilson's Phalarope	<i>Phalaropus tricolor</i>			
Birds	Wilson's Warbler	<i>Wilsonia pusilla</i>	X		X
Birds	Winter Wren	<i>Troglodytes troglodytes</i>	X		
Birds	Wood Duck	<i>Aix sponsa</i>			
Birds	Wrentit	<i>Chamaea fasciata</i>	X		X
Birds	Yellow Warbler	<i>Dendroica petechia brewsteri</i>		X	
Birds	Yellow-billed Magpie	<i>Pica nuttalli</i>			
Birds	Yellow-breasted Chat	<i>Icteria virens</i>			
Birds	Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>			
Birds	Yellow-rumped (Audubon's) Warbler	<i>Dendroica coronata</i>		X	
Birds	Yellow-rumped (Myrtle) Warbler	<i>Dendroica coronata</i>		X	
Mammals	Audubon Cottontail	<i>Sylvilagus audubonii</i>			
Mammals	Badger	<i>Taxidea taxus</i>			
Mammals	Big Brown Bat	<i>Eptesicus fuscus</i>			
Mammals	Black Rat	<i>Rattus rattus</i>			
Mammals	Black-tailed Hare	<i>Lepus californicus</i>		X	
Mammals	Bobcat	<i>Lynx rufus</i>			
Mammals	Botta Pocket Gopher	<i>Thomomys bottae</i>	X		X
Mammals	Brazilian Free-tailed Bat	<i>Tadarida brasiliensis</i>		X	X
Mammals	Broad-footed Mole	<i>Scapanus latimanus</i>		X	X
Mammals	Brush Mouse	<i>Peromyscus boylii</i>		X	X
Mammals	Brush Rabbit	<i>Sylvilagus bachmani</i>	X		X
Mammals	California Ground Squirrel	<i>Spermophilus beecheyi</i>		X	X
Mammals	California Meadow Mouse	<i>Microtus californicus</i>	X		X
Mammals	California Mouse	<i>Peromyscus californicus</i>		X	X
Mammals	California Myotis	<i>Myotis californicus</i>		X	
Mammals	California Pocket Mouse	<i>Perognathus californicus</i>			
Mammals	Common Opossum	<i>Didelphis marsupialis</i>		X	X
Mammals	Coyote	<i>Canis latrans</i>		X	
Mammals	Deer Mouse	<i>Peromyscus maniculatus</i>		X	X
Mammals	Desert Wood Rat	<i>Neotoma lepida</i>			
Mammals	Dusky-footed Wood Rat	<i>Neotoma fuscipes</i>	X		X
Mammals	Fox Squirrel	<i>Sciurus niger</i>	X		X
Mammals	Fringed Myotis	<i>Myotis thysanodes</i>			
Mammals	Gray Fox	<i>Urocyon cinereoargenteus</i>	X		X
Mammals	Hairy-winged Myotis	<i>Myotis volans</i>			
NOTE: OBS = OBSERVED, EXP = EXPECTED					

RESOURCE INVENTORY CHECKLIST:WILDLIFE: LEONA HEIGHTS

CLASS	COMMONNAME	LATIN NAME	OBS	EXP	BREEDING
Mammals	Heermann Kangaroo Rat	<i>Dipodomys heermanni</i>			
Mammals	Hoary Bat	<i>Lasiurus cinereus</i>			
Mammals	House Mouse	<i>Mus musculus</i>		X	X
Mammals	Kit Fox, San Joaquin	<i>Vulpes macrotis</i>			
Mammals	Little Pocket Mouse	<i>Perognathus longimembris</i>			
Mammals	Long-eared Myotis	<i>Myotis evotis</i>			
Mammals	Long-tailed Weasel	<i>Mustela frenata</i>		X	X
Mammals	Lump-nosed Bat	<i>Plecotus townsendii</i>			
Mammals	Mountain Lion	<i>Felis concolor</i>		X	
Mammals	Mule Deer	<i>Odocoileus hemionus</i>	X		X
Mammals	Muskrat	<i>Ondatra zibethica</i>			
Mammals	Norway Rat	<i>Rattus norvegicus</i>		X	
Mammals	Ornate Shrew	<i>Sorex ornatus</i>			
Mammals	Pallid Bat	<i>Antrozous pallidus</i>		X	
Mammals	Pig, Feral	<i>Sus scrofa</i>			
Mammals	Pinyon Mouse	<i>Peromyscus trueii</i>			
Mammals	Raccoon	<i>Procyon lotor</i>		X	X
Mammals	Red Bat	<i>Lasiurus borealis</i>			
Mammals	Red Fox	<i>Vulpes fulva</i>			
Mammals	Ringtail	<i>Bassariscus astutus</i>			
Mammals	Salt Marsh Harvest Mouse	<i>Reithrodontomys raviventris</i>			
Mammals	Saltmarsh Wandering Shrew	<i>Sorex vagrans halicoetes</i>			
Mammals	San Pablo Vole	<i>Microtus californicus</i>			
Mammals	Silvery-haired Bat	<i>Lasionycteris noctivagans</i>			
Mammals	Spotted Skunk	<i>Spilogale putorius</i>			
Mammals	Striped Skunk	<i>Mephitis mephitis</i>		X	X
Mammals	Townsend's big-eared Bat	<i>Corynorhinus townsendii</i>			
Mammals	Trowbridge Shrew	<i>Sorex trowbridgii</i>		X	
Mammals	Vagrant Shrew	<i>Sorex vagrans</i>			
Mammals	Western Harvest Mouse	<i>Reithrodontomys megalotis</i>		X	X
Mammals	Western Pipistrelle	<i>Pipistrellus hesperus</i>			
Mammals	Yuma Myotis	<i>Myotis yumanensis</i>			
Reptiles	Blunt-nosed Leopard Lizard	<i>Gambelia silus</i>			
Reptiles	California Black-headed Snake	<i>Tantilla planiceps</i>			
Reptiles	California Legless Lizard, Silvery	<i>Anniella pulchra</i>			
Reptiles	California Mountain Kingsnake,Coast	<i>Lampropeltis zonata</i>			
Reptiles	Coachwhip, San Joaquin Whipsnake	<i>Masticophis flagellum</i>			
Reptiles	Coast Horned Lizard, California	<i>Phrynosoma coronatum</i>			
Reptiles	Common Garter Snake, San Francisco	<i>Thamnophis sirtalis</i>		X	X
Reptiles	Common Garter Snake, Valley	<i>Thamnophis sirtalis</i>			
Reptiles	Common Garter Snake,Calif.Red-sided	<i>Thamnophis sirtalis</i>		X	X
Reptiles	Common Kingsnake, California	<i>Lampropeltis getulus</i>		X	X
Reptiles	Gilbert's Skink, Variegated	<i>Eumeces gilberti</i>		X	X
Reptiles	Glossy Snake, California	<i>Arizona elegans</i>			
Reptiles	Gopher Snake, Pacific	<i>Pituophis melanoleucus</i>		X	X
Reptiles	Long-nosed Snake, Western	<i>Rhinocheilus lecontei</i>			
Reptiles	Night Snake, California	<i>Hypsiglena torquata</i>			
Reptiles	Northern Alligator Lizard, SF	<i>Gerrhonotus coeruleus</i>		X	X
Reptiles	Racer, Western Yellow-bellied	<i>Coluber constrictor</i>		X	X
Reptiles	Ringneck Snake, Pacific	<i>Diadophis punctatus</i>		X	X
Reptiles	Rubber Boa, Pacific	<i>Charina bottae</i>			
Reptiles	Sagebrush Lizard, Northern	<i>Sceloporus graciosus</i>			
Reptiles	Sharp-tailed Snake	<i>Contia tenuis</i>		X	X
Reptiles	Side-blotched Lizard, California	<i>Uta stansburiana</i>			
Reptiles	Southern Alligator Lizard, Calif.	<i>Gerrhonotus multicarinatus</i>	X		X
Reptiles	Striped Racer, Alameda	<i>Masticophis lateralis lateralis</i>			
Reptiles	Western Aquatic Garter Snake	<i>Thamnophis couchi</i>			
Reptiles	Western Aquatic Garter Snake,S.Cruz	<i>Thamnophis couchi</i>			
Reptiles	Western Fence Lizard, Northwestern	<i>Sceloporus occidentalis</i>	X		X
Reptiles	Western Pond Turtle	<i>Clemmys marmorata</i>			
Reptiles	Western Rattlesnake, North.Pacific	<i>Crotalus viridis</i>		X	X
Reptiles	Western Skink, Western subspp.	<i>Eumeces skiltonianus</i>		X	X
Reptiles	Western Terrestrial Garter Snake	<i>Thamnophis elegans</i>		X	X
Reptiles	Western Whiptail, California	<i>Cnemidophorus tigris</i>			
Reptiles	Whipsnake, Alameda	<i>Masticophis lateralis euryxanthus</i>		X	X
Invertebrates	Longhorned Fairy Shrimp	<i>Branchinecta longiantenna</i>			
Invertebrates	Vernal Pool Fairy Shrimp	<i>Branchinecta lynchi</i>			
NOTE: OBS = OBSERVED, EXP = EXPECTED					

Appendix C: THE EAST BAY HILLS WILDFIRE PROBLEM

THE EAST BAY HILLS WILDFIRE PROBLEM

The East Bay Hills have lost more than 3,542 homes to major wildfires...almost as many as all of the high risk Southern California Counties combined. The 1991 Oakland/Berkeley fire ranks first as the State's largest home loss from wildfire, and the 1923 Berkeley fire ranks fourth. Thirty nine percent (39%) of the residences destroyed in California's 30 major wildfires, taking more than 50 structures, have been lost in the East Bay Hills. The LA basin is second with 21% and Santa Barbara County is third with 11%. The \$1.7 billion Oakland/Berkeley wildfire is this Nations fifth most costly catastrophe. The 1991 wildfire is preceded only by hurricanes Andrew and Hugo, the 1993 East Coast floods, and the Northridge earthquake. In terms of direct threat to residences, it is now clear that the East Bay Hills are one of the most severe fire risk areas in the State and Nation.

East Bay communities have made some improvements, over the past 7 years, in residential and neighborhood safety and fire fighting capability. However, the reasons why the 1991 fire could not be stopped as it moved through wildlands and residential areas still exist today in many locations throughout the East Bay Hills.

- Residential developments in the Hills have occurred, over the past 70 years, with little regard for the risks of a major Diablo wind driven wildfire.
- Major increases in flammable vegetation and structures, over the past 70 years, have significantly increased the wildfire risk. Steep hillsides have been converted from grazed grasslands to hillside and ridge top homes, surrounded with flammable vegetation, often under or adjacent to groves of unmaintained pine or eucalyptus.
- Neighborhoods currently exist with large numbers of homes with wood shingle roofs and excessive levels of flammable vegetation on the lot. Some homes have been placed in locations that are undefendable today, given the wildfire characteristics of natural vegetation on steep hillside slopes.
- Narrow roads, overhead power lines, variable water pressure and volume at Hill fire hydrants all make firefighting difficult under the best of conditions in the Hills, and impossible under the worst of conditions.
- Unmaintained eucalyptus and pine groves, on both private and public lands, represent a serious crown fire and spotting threat to adjacent residential areas.
- Diablo wind fires under the worst of conditions move so quickly that positioning fire crews and obtaining air support before the fire is out of control may not be possible given current fuel levels.
- With Redflag, Diablo winds blowing across ridge tops and down steep hillsides, fire fighters, given today's fuels, may not be able to directly control an early morning, wind driven wildfire ... until the late afternoon when the wind stops.
- Urban fire departments may be called upon to fight a rapidly expanding East Bay Hills Diablo wind fire once every 10, 20 or 40 years, and therefore can not have the same level of experience, resources, and equipment equivalent to their more traditional structural firefighting mission.

FIRE HISTORY

Fire records for the East Bay Hills are sketchy, yet newspaper clips and old fire planning studies document an active and dangerous fire history. **During the 75 year period between 1923 and 1998, eleven Diablo wind fires alone burned 9,840 acres, destroyed 3,542 homes, took 26 lives, with over 2 billion dollars in financial loss.** During the same period, three large west wind fires burned 1,230 acres of grass, brush, trees, and 4 homes.

NEWS REPORTS DOCUMENT FIRES THAT HAVE THREATENED THE EAST BAY

1923 Berkeley/North of Campus- 584 homes were destroyed by a Diablo wind fire that started on the ridge, at 12 noon, on a Monday in September. "No conflagration was ever more out of control. None ever demonstrated more vividly its power to defy all defensive resources once it gained headway. It was extinguished only by an act of providence."

1931 Leona- 5 homes were lost and 1,800 acres burned by a Diablo wind fire that started at 7 a.m., on a Monday morning in November. "Splitting of the fire into two huge infernos left the hundreds of fire fighters almost helpless to combat the double conflagration."

1933 Redwood/Joaquin Miller- 1 life and 5 homes were lost with 1,000 acres burned by a Diablo wind fire that started on the ridge, at 7 a.m., on a Monday morning in November. "The fire traveled along the tops of the thick groves of trees for great distances, never reaching the ground until after the main blaze had passed."

1937 Broadway Terrace- 4 homes were lost and 1,000 acres burned by a West wind fire that started at 3 p.m., on a Saturday afternoon in September. "Lack of water caused by exhaustion of reservoirs in the hills hampered fire fighters. The fire at times crept slowly through the brush and at other times leaped from treetop to treetop."

1946 Buckingham/Norfolk- 1,000 acres were burned by a rekindled ridge top Diablo wind fire at 5 a.m., on a Monday morning in September. "Sheer-walled canyons were quickly raging infernos. Flames raced so fast in the stiff wind they formed a fiery canopy over stands of pine and eucalyptus."

1960 Leona- 2 homes were lost and 1200 acres were burned by a Diablo wind fire that started at 11 a.m., on Saturday morning in October. "The 84 degree temperature and low humidity aided the flames which roared with express train speed up steep slopes....flames roared 50 ft. into the air."

1970 Buckingham/Norfolk- 37 homes lost, 36 damaged, and 204 acres burned in a Diablo wind fire that started near the ridge, at 10 a.m., on a Tuesday morning in September. "The wind was swirling in every direction. The heat was so great that some houses were exploding before the fire actually reached them."

1980 Berkeley/Wildcat- 5 ridge top homes were lost in a Diablo wind fire that started at 2 p.m. on a Saturday afternoon in December. "The blaze, fed by thick underbrush and tree (eucalyptus) debris, was so hot and fast that homes literally exploded."

1991 Oakland/Berkeley- The fire was rekindled at 10:45 a.m. below Buckingham/Norfolk roads, on a Sunday morning in October by a ridge top Diablo wind. "The firestorm burned over three square miles...killed 25 people, gutted 2,900 homes and caused \$1.68 billion in damage. It was the most destructive wildfire in California history."

DIABLO WIND, THE KEY ENVIRONMENTAL FACTOR- Under normal conditions, fires that start in the East Bay hills are efficiently controlled by firefighters, with no loss of homes. During most of the year, temperatures are moderate, and vegetation is relatively moist and fire-safe. Summers bring overnight and morning fog along the hills until noon, with moist mid-day winds blowing westerly in from the coast. However, there are a few days each year when all of the high fire danger conditions are extreme with low humidity, high temperatures, and hot dry Diablo winds blowing in from the East. These high fire danger conditions are labeled Red Flag days, and usually occur in the September to November fall months.

Diablo Winds turn everything around. They blow from the East, often in the early morning, when we least expect a major fire, and can fan the flames of the smallest spark into a wildfire that can move down from the ridge in 30 minutes, expand to one square mile in one hour, and consume hundreds of residences in one hot, dry, windy, fall day. We now know that under current conditions firefighters may not be able to stop all Diablo Wind fires, and that several areas in the East Bay Hills can produce flame fronts that can't be controlled with water from hydrants, fire truck hoses, helicopter buckets, or with retardant drops from air tankers.....until the wind slows in the late afternoon.

Quotes from two key fire planning documents describe the wind, weather factor:

March 1936. General Fire Plan for the Proposed East Bay Regional Park. Mr. L.E.Gray, Fire Weather Official of the U.S.Weather Bureau.

"The East Bay Hills are in a predominantly transitional marine environment on the average, but which are subject, especially during the fall months, to occasional continental influences which transfer, in effect, the interior climate to the coastal belt. Hence, from a fire viewpoint, the zone represents on the average a region of low to very low climatic hazard, with occasional very serious danger, especially in the fall months of September, October, and sometimes November. "The normal fire business in the zone is small. However, during the prevalence of upper air winds of north to east directions, dynamic heating and drying of air descending from the mountains to the north and east creates exceptionally critical conditions in the zone, especially near the toes of leeward slopes. Such winds are occasionally very strong, reaching velocities as high as 80 miles per hour at two to three thousand feet above sea level. All such air movement is associated with and caused by high pressure over the Northern and Central Great Basin region, and materially lower pressure to the south, southwest and west, over and to westward of California." "It may be pointed out that the largest fires affecting California have all occurred with dangerous winds from north to east, and in the transitional coastal zone. Northeast winds from altitudes of 7000 feet or more in the Sierra and Siskyou mountains are heated 1 degree F, by compression, for every 183 feet of descent. If the air starts over the Sierra at a temperature of 30 and a humidity of 50%, by the time it reaches the Grizzly peak region the humidity would become as low as 6% to 8%, with a temperature of over 90."

October 20 1991 The Oakland/Berkeley Hills Fire, , National Wildland/Urban Interface Fire Protection Initiative Report

"Weather contributes as much to the life of a wildfire as the fuels do. Temperature, lack of precipitation, and humidity provide the conditions for a fire to start, and the wind nourishes the blaze. Relative humidity and temperature are interrelated. As the temperature rises, relative humidity drops. If the temperature rises by 20 F, the relative humidity will drop by about 50 percent. Relative humidity controls the moisture content of fuels, and therefore their susceptibility to fire. Fuels with 20 percent moisture can catch fire; light fuels with 2 percent moisture can burn like gasoline." "So-called Diablo winds in the East Bay occur in May and October, These winds occur when an inversion layer builds up in the Bay area and forces air moving west from the San Joaquin Valley to speed up as it moves down the west, or lee, side of the hills. When it can go no further laterally, it moves up and over the ridges and then down. As it flows downward it increases in temperature. The Diablo winds are foehn winds that force the convection currents down against the natural flow that normally blows up the hills. The phenomenon represents a swirling effect much like a tornado, picking up embers from one place and depositing them in another. Another phenomenon that led to the rapid spread of the 1991 fire was development of a thermal inversion layer. The thermal inversion layer during the Oakland Hills fire was at 3,500 feet. The layer trapped heat from the fire and spread it out, adding to the preheating of vegetation and structures in the area."

STYLE OF DEVELOPMENT SIGNIFICANTLY INCREASED FIRE RISKS- By the 1930s residential development began to replace grazed grasslands by creeping up the slopes of the hills to take advantage of the spectacular views of the Bay. Narrow and winding road systems were laid out for pre-W.W.II residential developments. During the next 60 years, thousands of new homes were placed on the ridges and steep hillsides, with no real access behind homes for fire crews to quickly attack fires moving through the flammable and unmaintained grass, brush lands, pine, and eucalyptus groves. Wood shingle or shake roofed houses with wood siding, were constructed in great numbers throughout the hills, often surrounded by junipers and native brush under dense tree canopies. Wood roofs, siding, decks, stairs, outbuildings, and fences represent some of the most flammable fuel in the hills. Power lines were hung on wooden poles, often under tall trees. Hill water and fire hydrant systems evolved over a 60 year period with numerous areas of low pressure, low water flows, and limited 2 hour reserves of water for fire fighting. Landscapers and homeowners planted the ever popular juniper in great quantities. Some homes are literally wrapped with junipers and other flammable ornamental plantings, some covering the wood siding and reaching up to the wooden eaves.

UNMAINTAINED, AGING PLANTATIONS SIGNIFICANTLY INCREASE FIRE RISKS- The East Bay's eucalyptus and pine plantations were established in the early 1900's. Eucalyptus were planted for hardwood production, and Monterey pines were planted to forest the barren hills in preparation for coming real estate developments. Many of the older pines are now showing the effects of time. Eighty year old

pine trees are beginning to fail as they become senescent, with beetle damage and pine pitch canker taking increasing numbers of trees. The Tasmania blue gum eucalyptus have produced unusually dense and flammable woodlands with up to 400 stems per acre 12 inches or larger in diameter (often more than 900 stems when sprouts are included) far exceeding the 30 to 50 trees per acre found in maintained fire safe groves found in a few locations in the hills. Large unmaintained groves of blue gum eucalyptus are recognized world wide as high fire risk trees with their habit of producing large quantities of flammable bark, branches and oily leaves that can provide fuel ladders to the crown, potentially carrying burning embers miles ahead of a fire front. Litter under dense Eucalyptus groves often exceed 50 tons of combustible material per acre, far above a fire safe standard of 5 tons per acre. Periodic winter freezes below 20 degrees have frequently damaged ridge top Eucalyptus trees causing increased fire risks in following years. The recently introduced and growing populations of Eucalyptus Longhorn Borers also presenting a new threat to the survivability of Eucalyptus in the East Bay and potentially increase the volume of dead material in the groves that can increase fire risks. Excessive fuel loads on the forest floor and fuel ladders to their high crown mean that these groves would be extremely flammable under any summer or fall high wind condition with control of a moving flame front in the groves almost impossible, and with serious ember spotting into adjacent neighborhoods.

HOW FIRES ARE FOUGHT IN THE WILDLANDS AND RESIDENTIAL INTERMIX- Wildlands form the eastern side of the hills, with large publicly owned open space areas and few structures. The intermix spreads across the western side of the hills and is a blend of residences and dense vegetation on steeply sloped hillsides, typically owned by private parties. Homes are found in both planned developments and on large lot custom sites.

The wildland zone is susceptible to large, fast running vegetation fires. Regional Park, City, and CDF firefighters in 2 and 4-wheel drive engines, with air support from CDF helicopters and airplanes dropping water and retardant, will jointly work to attempt to control fires in the wildland zone. Fire trails are located throughout the wildlands and provide access for fire crews, equipment, and serve as breaks for containing smaller fires. Under extreme Diablo wind conditions, direct attack at the rapidly moving flame front would be difficult, if not impossible. Fire crews would work the flame front, and if not successful would fall back to the ridge fuelbreak, setting backfires, in an attempt to keep the wildfire from spreading west and down into the intermix residential zone.

The intermix zone is by far the most difficult and complex fire problem for both residential and vegetation fires. Firefighters in structural engines on paved roads and 4 wheel drive engines in the open space areas, work fires in this zone supported by CDF helicopters and airplanes. Fire hydrants are located in the zone, but water volume and pressures vary greatly. Paved mountain roads provide access for fire engines. However, many older roads are steep, winding, narrow, and often are constricted by cars parked on road shoulders and under fire situations, by evacuating residents. The firestorms that have destroyed so many East Bay homes have started near the intermix, close to the ridge, and were then blown by extreme Diablo winds down the steep slopes. Lateral movement of these hill fires is driven by swirling wind currents and upslope spread. Wind-blown embers from the ridge and upper slopes set off both vegetation and structural fires ahead of the flame front

THE 1995 FIRE HAZARD MITIGATION PROGRAM & FUEL MANAGEMENT PLAN- Following the disastrous Oakland-Berkeley fire of 1991, the East Bay Hills Emergency Forum (Oakland, Berkeley, East Bay Regional Park District, East Bay Municipal Utility District, Lawrence Berkeley Laboratory, and University of California at Berkeley) was formed to coordinate emergency planning among fire agencies and land management agencies, and to develop a new fire hazard mitigation program and plan for the Hills. The draft of the new Plan was completed in the summer of 1995, and was reviewed and approved by the East Bay Hills Emergency Forum at their October 19, 1995 meeting. The new Plan uses up-to-date fire science concepts, and recommends a unified approach for public agencies and homeowners to follow in reducing the considerable fire risks present in hill residential areas, and wildlands that threaten "values at risk".

Summary of Residential Area Hazards and Mitigation Proposals Approximately 50 % of the planning area is classified as residential for which four different products were developed to address mitigating fire hazards on private property. The GIS was used to rate residential areas by structural roofing and siding, vegetation fuels, defensible space, wildland threat, roads and slope.

Summary of GIS Products and Derivatives The Fire Study Area GIS is an interactive computer program that includes a number of factors used in fire hazard assessment for both wildlands and residential areas. The Study Area GIS is composed of layers of digital information displayable in map form with relevant data attributes spatially connected. The GIS data set is available in CD format, making extensive inventory and research data available to public agencies, homeowners, and others interested in mitigating wildfire risks. The GIS was used to produce a technical chart that identifies all of the Vegetation polygons, charting attributes for vegetation type, acres, fuel model, development stage, crowning potential, slope class, flame lengths, rate of spread, heat per area and ignition potential rating.

Summary of Wildland Hazards and Mitigation Proposals The Eastern 50% of the planning area is classified as wildlands for which a number of products were prepared to identifying wildland fire hazards, to recommend tools for managing vegetation, and to propose strategies for creating defensible zones at the residential/wildland interface to mitigate the risks of wildfires moving from wildland areas into residential communities. Wildland vegetation was modeled for fire conditions set at a 95% worst case condition under a Diablo Wind. Flame lengths greater than 8' are considered "out of control" and are possible on 10,500 acres of wildland areas within the study area with 8,000 acres having less than 8' flame lengths. The Plan recommends that fuelbreaks should be created at the residential/urban interface and maintained to keep flame lengths below 8' in the areas where firefighters are most likely to attempt to protect residences and other "values at risk".

Typical Plant Communities	Description- Development Stage	Flames	Spread Rate
Dry Scrub, Eucs.-20yrs, Broom, Hardwoods, Succ. Shrub	Brush, patchy grazed grass- low dev. stage	10	79
Primary Fire Carrier- Brush at 6' with high fuel loads	Brush w/short grass- medium	14	130
	Brush about 2'- high	18	134
	Brush up to 6'- extreme	32	377
Eucalyptus 1-5 Years Old	Eucalyptus 1 to 5 years- high dev. stage	22	147
P. F. C.-Eucs. (1-5yrs) with fuel ladders and 6' brush			
Eucs., Pine, & Mixed Hardwood Woodland	Mature Trees, lesser fine fuels & logs-low	6	15
P.F.C.- Mature Trees, distributed larger fuels on floor	Mature Trees, 6" litter depth- moderate	9	27
	Mature Trees, medium floor litter - high	12	45
	Mature Trees, litter up to 12" - extreme	20	113
Grassland and Oak Savannah	Short Grass- low dev. stage	2	34
P.F.C.- Grass >2' -fine, cured, continuous	Short Grass- medium	5	103
	Short Grass- high	10	446
	Short Grass- extreme	21	803
Grassland, Oak Savannah, Dry Scrub<30%	Tall Grass, sparse no thatch- low dev. stage	7	123
P. F. C.- Grass 2' to 3'< -course, difficult walking	Tall Grass, patchy, some thatch - medium	12	332
	Tall Grass 3' - high	29	525
	Tall Grass 3'< - extreme	37	1160
Mature Pines- Low Density	Low Density Pines- low dev. stage	3	17
P. F. C.- Grass under brush or open trees	Low Density Pines- medium	8	88
	Low Density Pines- high	16	241
	Low Density Pines- extreme	20	217
Mat. Forest- Euc, Pine, Hardwoods, Redwoods, Riparian	Forest, no understory-low dev. stage	1	1
P. F. C. - Tree litter with tightly compacted dead foliage	Forest, no understory-medium	2	4
	Forest, little understory-high	2	8
	Forest, dev. understory, 2" litter-extreme	6	32
	Forest, 6" litter layer-medium	5	24
	Forest, concentrations of litter-high	7	53
	Forest, 12" litter layer-extreme	14	121
Old Scrub, Chap., Succ. Shrub>30%	Old Scrub up to 4' - low dev. stage	7	36
P. F. C. - Brush at 4' with litter or grass under	Old Scrub 4' to 6' - moderate	24	195
	Old Scrub about 6' - high	46	408
	Old Scrub over 6' - extreme	69	863

WHAT "FIRE SAFE" MIGHT LOOK LIKE WHEN THE NEW PLAN IS FULLY IMPLEMENTED

- Wood shake and shingle roofs would be replaced with non-flammable materials. Homes and neighborhoods would be made defensible to improve their ability to survive a wildfire.
- Vegetation in hill neighborhoods would be maintained with 100 foot (200' for some vegetation types on steep slopes above 40%) defensible space clearances around residences, with all flammable plants and dead or dry materials removed each summer, to the property line.
- Juniper, broom, and other extremely flammable vegetation would be replaced with less flammable plants that are properly maintained to prevent fire spread from embers or flame fronts into structures.
- Fuelbreaks would be maintained along the main East Bay Hills ridge top and along the wildland/residential interface to provide firefighters with enough defensible space to safely make their stands against a wind driven fire.
- Vegetation on ridge tops would be open with mosaics of grassland, maintained brush, and trees spaced to prevent crown fire. Prescribed fire would be used regularly in fuelbreak and wildland areas to keep fuel levels low and to create a more natural, open landscape that is relatively fire-safe.
- Grasslands bordering residential areas would be mowed or grazed, and brush lands would be kept thin and young to reduce the risk of fast moving flash fires that can quickly expand to involve large acreage and wide flame fronts.
- Eucalyptus and pine plantations would be thinned or removed, ground fuels maintained for fire safety, and fuel ladders eliminated to reduce the risk of crown fires that can throw embers great distances into residential neighborhoods.

THE ROLE OF THE EAST BAY REGIONAL PARK DISTRICT- The District, since its creation in 1934, has been a major property owner in the East Bay Hills, and has long been concerned with the risks of uncontrolled wildfire. The District has its own fire department, has conducted numerous vegetation management programs to reduce wildfire risks, and has created and maintains a 15 mile long mosaic of grassland, thinned brush, and well spaced trees as a ridge top fuelbreak along the western boundary of its East Bay Hill parks. The original fuelbreak was a joint agency project and was created in 1974 as a 300' wide clearance of freeze damaged eucalyptus trees on Park District, City of Oakland, Water District and UC property.

Renewed interest in fire safety and fuelbreak maintenance resurfaced in 1980 following the Berkeley fire that destroyed 5 ridge top homes. At the request of the mayor of El Cerrito and the mayors of several East Bay cities, the District formed a multi-agency Blue Ribbon Fire Safety Committee to prepare an updated fire safety plan for the East Bay Hills. The Blue Ribbon Report recommended that cities take steps to make hill residential areas fire-safe, and also recommended continued maintenance of the original fuelbreak with additions in several locations to provide defensible space for ridge top residences that were not protected by the 1974 fuelbreak. The new fuelbreaks generally involved vegetation other than eucalyptus and are defined as a 125' vegetation management zone below homes along the ridge. Homeowners were responsible for removing flammable vegetation to their property line with the District and other public agency landowners to maintain vegetation on public lands to achieve the 125 foot defensible zone. the 1982 Blue Ribbon Fire Hazard Reduction Report was completed and adopted by all of the participating agencies.

Following the 1991 Oakland/Berkeley firestorm, the East Bay Hills Vegetation Management Consortium was commissioned by the Hills Emergency Forum to develop a new fire hazard mitigation program and plan for the hills. The Park District's Board in the fall of 1996, after considerable public review and discussion, adopted a resolution accepting the East Bay Hills Fire Hazard Mitigation Program and Plan and authorized staff to implement its concepts.

PARK DISTRICT RESOURCE MANAGEMENT AND FIRE MITIGATION POLICIES- The District's Board of Directors has adopted a number of policies that guide the District in responding to the risk of wildfire. Two of the most recent and relevant policies are the "Fire Weather Operating Plan for Park Closures" and the "Fire Hazard Mitigation Program and Fuel Management Plan for the East Bay Hills". The District's Master Plan, the Wildlands Manual, and the IPM Manual also provide direction for staff in protecting wildlife, special features, important habitat, and the use of IPM strategy (including minimizing and careful use of chemicals) for managing pest species. The District's Board of Directors, in adopted Park Plans and Environmental Impact Reports, has authorized fuelbreaks and wildland fire hazard reduction efforts at Anthony Chabot, Redwood, Huckleberry, Sibley, Claremont Canyon, Tilden, Temescal, and

Wildcat Parks. Board adopted park plans also include a number of specific policies for managing eucalyptus, pine, brush lands, grasslands, and other resources to maintain desired native plant ecosystems, and to meet other park objectives.

Management of "natural" park resources may seem an inappropriate concept. However, vegetation in the East Bay Hills has always been managed by humans who reside here. Native plant communities adapted to the use of fire by Ohlones and animal grazing, until native people, fire, and native herds were removed from the land or eliminated in the early 1800s. Introductions of European grasses, logging of redwood forests, plantings of extensive eucalyptus and pine plantations along with a host of invasive exotic plants had significantly impacted future park plant communities by the early 1990s. More recently, the removal of cattle grazing in newly acquired parklands in the 1940s, allowed shrub and brush species to displace the extensive grasslands and spectacular wildflower areas that were healthy plant communities in parks during the early years, followed by extensive plantings of introduced trees in groves by early park administrations. These impacts, along with recent invasions of broom, thistle, and densely overgrown brush lands and woodlands have contributed to making some plant communities less native, more dense and unnatural, and more flammable.

Fortunately, some East Bay Hill park plant communities have resisted many of the impacts of human introductions and are rebounding to become healthy and relatively fire safe ecosystems that are sustainable into the future. Second growth redwoods, bay-oak woodlands, riparian woodlands, and many native brush land and grassland areas, with a reasonable level of care and attention can form excellent natural environments in hill park wildlands.

Plantations of eucalyptus and pine, and a host of invasive exotic plants, that are not a part of the native landscape, should not be viewed as permanent occupants of park wildlands. These areas will require more drastic long term management strategies to re-establish "native" plant communities that will become more stable and fire safe in the future. Introduced exotics and domestic species that compete with and displace native species and compound the fire problem should be removed or treated to reduce risks as soon as economically feasible.

The District has formulated vegetation management policies in adopted LUDP/EIR's for the East Bay Hill parks using the following principles:

- Oak/Bay woodlands, riparian, and redwood plant communities are natural, relatively fire safe, and should not generally be managed except that substitutes for naturally occurring process, i.e. cool fires, and light hand crew thinning, may be carefully used to recreate a more open and natural-like plant ecosystem.
- North/East facing slopes should be allowed to progress naturally from grassland to brush land to Oak/Bay woodland.
- Interior park vegetation should not generally be managed except for the purpose of encouraging more native and natural plant communities.
- Grassland areas should be preserved and in some cases re-established to retain this important plant community in East Bay Hill parks. Ridge tops and south/west slopes are appropriate as grasslands, and in most cases will require ongoing grazing, mechanical, or other IPM strategy to control brush invasion.
- Eucalyptus and pine conversion to native species is a long term goal with economics and public acceptance being the main factors in determining the pace of this transition. Management of eucalyptus and pine plantations to reduce fire risks is necessary and appropriate. Conversion from eucalyptus or pine will not be accomplished easily, with transition to a grassland/brush land mix, oak/bay woodland, or other appropriate native plant community a long term goal.
- Management of park vegetation to reduce fire risks to adjacent residential areas should be limited to designated fuelbreaks along the ridge top or residential boundary and to the management of eucalyptus and pine plantations by thinning, removal, or use of prescribed fire to reduce fuel volume and the threat of crown fire.

PROPERTY OWNERS ARE RESPONSIBLE AND MUST KEEP THEIR PROPERTY DEFENDABLE-

Property owners who choose to live next to wildland areas or in especially high risk environments must assume the primary responsibility for ensuring that their homes will have enough defensible space to give firefighters a chance to save structures threatened by wildfire. In hill areas of the East Bay, it is prudent to

maintain a minimum 100 foot defensible zone around residences with all structures having a class A roof and fire resistant siding. In many areas urban developments have encroached into wildland settings without adequate consideration given to fire risks and fire protection requirements. Property owners who have placed themselves in this situation will need to maintain expanded defensible clearings around their structures and possibly add additional protective measures like automatic or manual foam systems to protect their structures. The spread of wildfire across property boundaries will occur given the steep slopes and vegetation found in most Hill wildland areas. However, the fire risk can be minimized through cooperative fire hazard reduction planning and implementation involving all landowners and fire fighting agencies. Protecting life and property at the residential interface requires coordinated resource management, careful site planning, public education, strategic fuel management, and aggressive firefighting capabilities.

CONFLICT OR FORCEFUL FIRE HAZARD REDUCTION- It is very surprising that hill residents have yet to develop a real consensus about the actions required for improved Diablo Wind wildfire safety...especially after the October '91 firestorm. Significant progress in firefighting preparedness and prevention has been achieved during the past seven years; however, the pace is slow and there are major policy decisions ahead, with costly long term hazard reduction projects that need funding. Optimism that this effort will continue into the future is not warranted because both Oakland and Berkeley have recently lost their Fire Assessment Districts that were spending almost 2.5 million dollars each year for defensible space inspections, fuel clearance projects, and neighborhood education and organization efforts.

The Park District is also having considerable difficulty in expanding its fire mitigation efforts with some individuals and environmental groups aggressively opposing efforts to implement fire hazard reduction projects listed in 6 Hill park Land Use Plans and Environmental Reports as well as contained in the recently completed Vegetation Management Consortium's Fire Hazard Program and Fuel Management Plan for the East Bay Hills. These individuals and groups are also opposing a \$500,000 grant from FEMA to be matched by another \$500,000 in Park District funds, already approved by the Park District's Board of Directors, for fire hazard reduction projects.

The multitude of divergent opinions by hill residents, environmental groups, public officials, and the general public will need to be focused before implementing more forceful and effective programs of fire hazard reduction. The varied nature of public opinion is typified by the following:

"I love the pine and eucalyptus forests. That's why I moved to the hills. Don't mess with the trees"

"We can't afford to replace our shingle roof, we're on a fixed income."

"What about biodiversity and the animals that will be killed or displaced if vegetation is removed?"

"People who build in the Hills should accept the full risk and get insurance!"

"Maybe it's nature's way of saying we overdeveloped the hills. I don't think firefighters can stop one of these major wildfires until Mother Nature slows the wind."

"No way will I clear my lot, I like it natural for the wildlife, and my privacy...it's too much work!"

"If Highway 13 couldn't stop the firestorm what good are fuel breaks and clearance around homes?"

"If I clear my lot, how can I be sure my neighbors and public agencies will clear theirs?"

"Fire fighters are paid to take the risks and protect my property. If my home burns it's their fault, and I will sue!!"

"I doubt that another firestorm will happen in my lifetime, but if it does I am fully insured."

PUBLIC OFFICIALS AND RESIDENTS MUST WORK TOGETHER

The magnitude of the East Bay Hills fire hazard problem calls out for a more realistic public consensus about what must be done to be reasonably safe. While public and media interest during an actual Hills fire is high, real progress in creating and maintaining a fire safe condition in the hills is lagging seriously.

The 1991 Oakland/Berkeley fire aptly demonstrated that blame can't successfully be placed at the feet of a single "culprit", a single property owner, unsafe neighborhoods, unsafe wildlands, or unsuccessfully executed emergency actions. The 1991 wildfire was an unfortunate, but predictable, chain-like combination of all of the above. The chain is still weak and strengthening one or two links will not be sufficient.

Solutions must address each of the multiple elements of the problem. To be effective, long term commitments of resources by the 28,000 landowners, and 6 Hills Emergency Forum member agencies who own property and provide firefighting services will be essential if we are to reduce the significant residential and wildland wildfire risks that exist today in the East Bay Hills. If we do not take effective steps, then by intent or default we become fatalists and must then rely on whatever insurance coverage is available to rebuild after each major wildfire occurs.....and reoccurs.

**Appendix D: TREATMENT PRESCRIPTION DESCRIPTIONS BY VEGETATION
TYPE**

Treatment Prescription Descriptions by Vegetation Types

Treatment methods and performance standards included in this paper are set forth as a regional blueprint for fuel management in the East Bay Hills. As more areas are treated utilizing the variety of techniques discussed, it is anticipated that these recommendations will be refined. The scientific community has been slow in showing interest in applied research documenting the effects and impacts on specific vegetation communities of fuel management in the East Bay hills. Most of the standards and special considerations established here are based on the experiences of public land managers who have been working in fuel modification, as well as common sense and available research to address known environmental considerations. As more work is undertaken to mitigate fire hazards it is hopeful that additional research will follow to provide VMC members more information regarding fuel management techniques that are effective at the lowest cost both environmentally and economically.

The following prescriptions summarize methods available for use in areas identified for treatment by the *Methodology for Development of a Regional Work Plan*. The prescriptions will serve as a basis for site specific refinements. The paper titled *Available Techniques for Vegetation Management on Public Wildland* provides additional detailed information on the potential treatment methods and limitations and should be used in conjunction with these prescriptions.

The prescriptions apply to those high hazard areas identified for treatments. Priority ranking for treatment includes 6 factors: proximity to residences or other "values at risk," adjacent neighborhood hazard ranking, fire behavior hazard assessment, crowning potential, ignition potential and proximity to regional evacuation/access routes. See paper titled *Methodology for Development of a Regional Work Plan* for more information on hazard analysis and prescription refinement. The paper titled *Fuel Model & Development Stage Descriptions* provides information regarding classification of vegetation into fuel models that are used to predict potential fire behavior and to establish the desirable fuel characteristics and treatment goals.

The following treatment prescriptions are organized by vegetation types utilized by the Graphic Information System (GIS) for the region. They are listed from the most easily ignited and hazardous to the least and include:

Grasslands	Monterey Pine Forest - Mature & Plantations
Brush & Scrub Dominant Communities	Mixed Hardwood Woodlands & Forest
Mature Eucalyptus Forest	Redwood Forest
Second Growth & 1 to 5 year old Eucalyptus Forest	Riparian Forest

The GIS information was developed on a regional basis. As actual work prescriptions are developed it is anticipated that this information will be refined to incorporate greater detail and gradation of vegetation.

Grasslands

Vegetation Description

Surface cover dominated by herbaceous plant materials and annual grasses. May include widely spaced trees such as the native Oaks and some brush species, but this comprises generally less than 30% of the overall cover. Special grassland types in study area include Oak Savannah, Serpentine grassland and areas of native perennial grasses.



Grasslands are easily ignited resulting in fires that can spread rapidly. Fortunately fire in grasslands respond to treatment of relatively narrow strips

Primary Fuel Characteristics

Fire Behavior and Responsiveness to Suppression:

Overall hazard is rated as moderate. The critical considerations in this vegetation type are the rate of spread and ease of ignition with grasslands acting as a vector to ignite other vegetation types. This is one of the most dangerous wildfire types for firefighter safety due to its rapid frontal spread that can catch suppression personnel off guard.

Grasslands can be categorized into two types from a fire behavior standpoint: Short grass (Model #1) and Tall grass (Model #3). For short grass, fire behavior typically remains within the range that suppression forces can manage with flame lengths between 2 and 10 feet. Tall Grasslands that have not been managed have been modeled to generate flame lengths that could overwhelm suppression forces ranging from flame lengths of 12 to 38 feet. However, due to the responsiveness of this vegetation type to suppression activities, tall grasslands are listed as a moderate hazard in spite of this tall flame lengths. Management of relatively narrow strips of grassland will result in the "laying down" of the fire; stopping it as it reaches the treated areas. Production of airborne embers ahead of the flame front is not typical due to the rapid rate of spread.

Ignition Potential: Most extreme hazard rating, especially in tall grasslands that have cured. Ignition index of 1 (on a relative scale of 1 to 10 with 10 as the most difficult to ignite).

Characteristics

- ◆ Annual grasses die back each summer forming a mostly dead fuel type
- ◆ Easy to ignite in the summer
- ◆ Carries fires into other fuel types in the summer. Serves as a damper to fire spread at other times (when live and green)
- ◆ Spreads rapidly
- ◆ Total heat output relatively low
- ◆ Responds quickly to changes in temperature and moisture (dries out or wets rapidly)
- ◆ Adapted to natural fire cycles. Most native perennial species either resprout easily to rejuvenate individual specimen after fire, require fire to trigger germination or fire actually enhances production by reducing competition by annual grasses.

Desired Fire Hazard Reduction Goals:

- ❖ Shorten height of grasses to decrease chance of carrying fire up into taller adjacent plant materials or structures.
- ❖ Shorten height of grasses to reduce overall fuel quantity

- ❖ Manage potential ignition sites (such as along roadsides, picnic areas, overlooks)
- ❖ Encourage native perennial grasses. In spite of the greater biomass/ fuel content perennial grasses are preferred to annual grasses since the perennials dry out later in the season and present a shorter period of potential ignition.
- ❖ Reduce brush encroachment to minimize heavy fuels and restrict fire duration.

Treatments

Special Considerations

- ❖ A number of grasslands types in the study area contain species of special concern, such as Presidio clarkia, Diablo helianthella and fragrant fritillary. Serpentine grasslands contain a large number of rare and endangered plants. Treatment of serpentine grasslands should be avoided entirely except burning using hand crews during suitable periods (late summer). Grasslands in fuel management areas should be periodically checked for the presence of burrowing owls. (See appendix for name, status, habitat and distribution of plant and animal species of special concern known to occur in the study area).
- ❖ Monitoring of treatments. The effect of fuel management in grasslands is not well documented. Follow up monitoring of the response to management practices need to consider grassland structure and composition, as well as fuel loading and measurement of residue.
- ❖ Seasonal considerations. Treatment after seed set and prime breeding periods (approximately July 1) will reduce disruption to nesting birds, and seed production of native perennial species. Additional limitation to treatment timing may occur if species of special concern are involved. The timing of treatment will need be on a case-by-case basis to balance seed set and breeding concerns with mowing of annual grasses to reduce ignitions and control of yellow star thistle encroachment.
- ❖ Treatment start dates should be based on field conditions and should not be calendar specific. Treatment too early in the season may require retreatment once grasses have fully cured and may be detrimental to desirable species if the treatment disrupts seed maturation.
- ❖ Perennial grasses are sensitive to duration and season of grazing. Short grazing periods are critical to avoid adverse impacts in these areas.

Potential Treatment Methods and Limitations

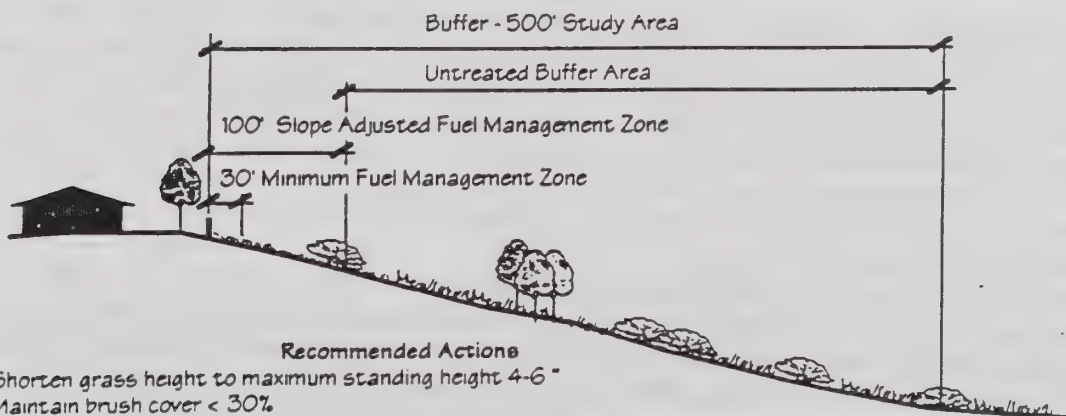
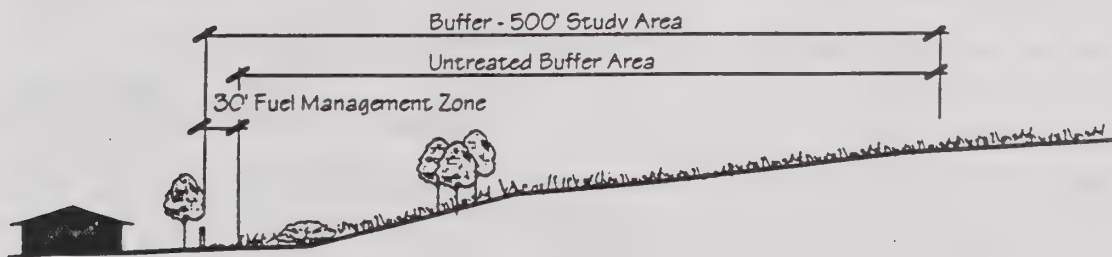
- ✓ Hand labor (weed whipping): Cutting the grasslands changes it's structure by "laying down" the fuel. The cut materials tend to blow away or decompose over time. Due to costs, the technique is recommended only for small areas warranting treatment. Must be done every year to reduce fuel.
- ✓ Grazing (cattle, horses, sheep and goats): Need to monitor animal selection with respect to seasonal grassland production, stocking rate, quantity and quality of residue left. Vegetation and wildlife response varies greatly by grazing practices utilized. Adverse grazing effects may include increased surface erosion, expansion of weed populations and depletion of sensitive herbaceous species. Goats may deplete Oak seedlings if not protected.
- ✓ Prescribed Fire: Broadcast burns in the summer or early fall will favor native plants. Can also burn in foggy periods using the fine grassy fuels to carry the fire (results are tied to fuel moisture and composition). Repeated prescribed burns necessary to remove annual grassland fuels may not be socially acceptable where adjacent to residential neighborhoods. Burning often can be made more acceptable if alternated in a cycle with other methods. Additional value as training drills for regional coordination of local fire departments.

- ✓ Mechanical (mowing): Good for roadsides and open fields. Equipment limitations on slopes greater than 30%, limited access or multiple obstacles. Similar to hand labor in that it does not remove fuel, but does change its structure by "laying down" the cut materials.
- ✓ Chemical: Common roadside treatment using post-emergent herbicides such as Glyphosate. This treatment is limited in its selectivity and often kills all herbaceous material with dead matter blowing away or decomposing over time. Timing is critical relative to appropriate growth stage and rainfall for treatment to be effective. Treated plants may appear unsightly and unnatural for a period of time.

Treatment Performance Standards

- ☐ Minimum treatment width 30 feet on slopes <20%. Increase width to 100 feet or more on slopes >20% (additional width may be required depending on topography and proximity of values at risk).
- ☐ Maximum standing height of dead grasses 4-6 inch range.
- ☐ Roadside treatment minimum of 10 feet on slopes <20% increase to 30 feet on slopes >20%.

Grasslands



Recommended Actions

- Shorten grass height to maximum standing height 4-6 "
- Maintain brush cover < 30%
- Annual treatment required after grasses have cured and seeds have set if species of special concern are present
- Anticipate annual treatment to manage treated areas to standards of Fuel Model #1 Short Grass (Moderate) or Fuel Model #3 Tall Grass (Low) with short grass height or patchy continuity of taller grass with minimal litter or dead stem wood.

Adjustment to increase width of Fuel Management Zone on wildland slopes below urban development

Slope	Minimum Width
0 - 20%	30'
>20%	100'

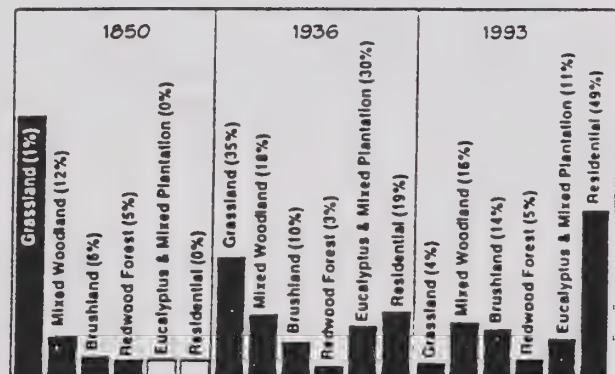
- ❑ Brush intrusion - crown cover 30% maximum. Reduce crown cover in treatment zone to 20% maximum for slopes greater than 20%.
- ❑ Grazing lease standards. Adopted standards must address:

Residual dry matter related to slope	Timing
Stocking Rates	Monitoring program & frequency
Protection (plants, riparian corridors, wetlands)	Supplemental feeding standards
Control program for spread of weedy exotics	Watering sites
- ❑ Special considerations to reduce re-introduction of exotic species must include equipment cleaning, feed restrictions, residual dry matter and seasonal restrictions.
- ❑ Anticipate annual treatment to manage treated areas to standards of Fuel Model #1 Short Grass (Moderate) or Fuel Model #3 Tall Grass (Low) with short grass height or patchy continuity of taller grass with minimal litter or dead stem wood.

Brush & Scrub Dominant

Dominated by shrubs with some grassland or woodland species present but comprising <30% of cover. Four vegetation types are recognized in this category:

- North Mixed Chaparral
- Successional Scrub
- North Coastal Scrub (Dry & Wet)
- Exotic Shrubs & Perennials



The amount of acres of brush & scrub dominant vegetation has increased in the study area over the last 100 years.

Source: A History of Vegetation Changes in the East Bay Hills 1850 - 1993

North Mixed Chaparral

Dominated by shrubs considered "hard chaparral" that vary in height from 2 to 12 feet. Special chaparral types in study area include Northern Mixed Chaparral, Alameda Manzanita and areas of successional shrubs where the emergent overstory trees cover greater than 30% of the area. Dominant plant species include: Ceanothus, Manzanita, Mountain Mahogany, Poison Oak and scrub Oak. Not a common vegetation type in the East Bay Hills. Often this vegetation type occurs in soils or on slopes that will not support other vegetation.

Primary Fuel Characteristic:

Fire Behavior and Responsiveness to Suppression

Overall hazard is rated as the most extreme and was modeled as Chaparral (NFFL model #4). Flame lengths range from 24 to 69 feet depending upon development stage and slope. This fire behavior is similar to North Coastal Scrub in overall characteristics, but is generally considered more hazardous due to chaparral's dense stands and high accumulation of litter. Chaparral produces greater heat release and very dramatic spread rates once ignited.

Ignition Potential: High hazard rating with an index of 6. This vegetation is more difficult to ignite than the north coastal scrub due to the limited understory grass and herbaceous materials.

Characteristics

- ◆ Natural structure (or form) of shrub with dense small leaves, twigs and litter supports fire in that these fine fuels are the first to ignite, with fire then moving into the larger woody

branches that fuel the fire. Community structure makes suppression difficult by often forming thick impenetrable stands with high continuity so fire passes from shrub to shrub.

- ◆ Many species have oils, resins or other volatile chemicals that make them burn faster and hotter
- ◆ High ratio of dead to live materials during certain stages of life-cycle. Natural life cycle of Chaparral includes build up of dead materials in the inside of the shrub that fuels a fire.
- ◆ Responds slowly to changes in temperature and weather
- ◆ More difficult to ignite than grass or north coastal scrub with its greater fine fuel loads, but once ignited burns rapidly in dry weather. Will burn after grass has sprouted after the first Fall rains.
- ◆ Carries fires from grasses into other larger sized fuel types
- ◆ Moderate to very high heat output
- ◆ Adapted to natural fire cycle. Most species resprout easily to rejuvenate individual specimen after fire, or require fire to trigger germination.

Desired Fire Hazard Reduction Results:

- ❖ Remove dead materials and litter.
- ❖ Remove individual specimens to reduce the overall plant density & fuel quantity
- ❖ Encourage natural succession to grasslands or woodlands if environmental conditions will support.
- ❖ Create clumps of chaparral groups to break up large expanses and slow rapid fire spread

Treatments

Special Considerations

- ⌘ High occurrence of species of special concern such as Alameda manzanita. While many populations have been located, it is unlikely that all populations occurring in the East Bay Hills have been identified. Surveys are needed for species of special concern prior to new treatments in this vegetation type.
- ⌘ Obligate seeders are plants that reproduce only by seed and will not stump sprout. These species need protection with care taken not to cut them to their base. In order to sustain populations suitable conditions must be present for seedling germination and establishment. Suitable conditions may mean clearing to bare mineral soil for some species.
- ⌘ The ecological effects of most treatment methods are not well documented. Surveys of plant and animal abundance and community structure following fuel reduction treatments are recommended.
- ⌘ Timing considerations -- treatments after approximately July 1 will greatly reduce disturbance to seed set of plants and nesting efforts of songbirds.
- ⌘ Encourage and protect tree specimens such as native Oaks and Bays that succeed into this vegetation type. Remove Eucalyptus or other invasive species.

Potential Treatment Methods and Limitations

- ✓ Hand Labor: Minimizes soil disturbance and targets only specified plants. May be the only viable treatments in Pallid or Alameda Manzanita or other endangered species areas. Fuel needs to be mulched, disposed off-site or pile burned to reduce fuel loading.
- ✓ Grazing (goats): Retains appearance of natural community, but may create change in structure and frequencies of species over time due to preferential browsing. Need to protect desirable species from extensive browse. Avoid grazing during seed production of non-target species, especially obligate seeders. Timing, duration & stocking rates of grazing relate to palatability and impact on targeted species.

- ✓ Prescribed Burn: Broadcast burning during wet season may have adverse effects on obligate seeders. Fire intensity of untreated chaparral during dry season may require use of initial treatments in areas with high fuel loads to prepare for future burns. Pile burns may be an alternative treatment to broadcast burns as an initial management in conjunction with other treatments..
- ✓ Chemical: Not recommended for widespread use due to public/ environmental concerns. May be utilized if eucalyptus is present in stand for direct application to eliminate eucalyptus seedlings or resprouts after cutting.

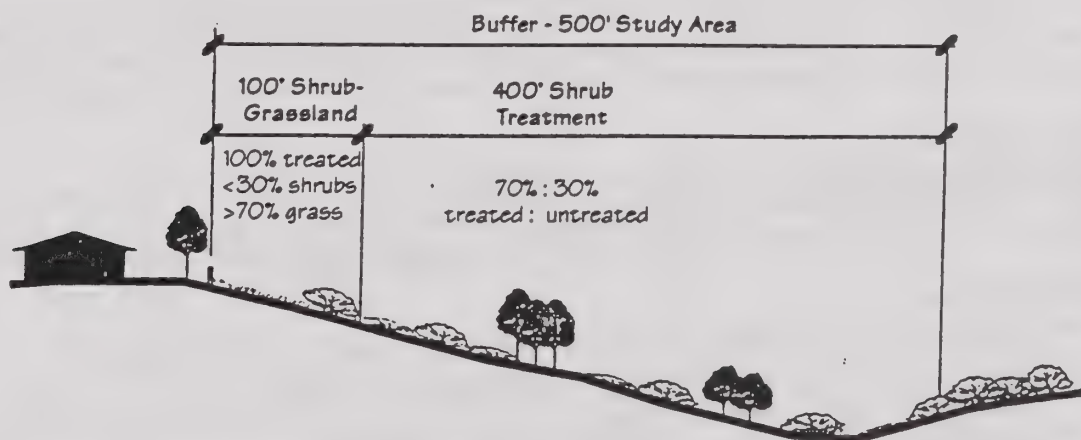
Treatment Performance Standards

- ☐ Stand structure for fuel modification areas:
 - Height: Thin or selectively remove exotic species and shrubs that will stump sprout to achieve desired vertical and horizontal discontinuity. Do not cut or crush species that are "obligate seeders."
 - Island size: less than 8 feet diameter or 2 times the height of the tallest shrub whichever is smaller. Create clumps that are natural in appearance including specimens of variable age classes. In areas that will not support grass or herbaceous materials between islands, reduce island spacing and mulch between islands to minimize invasive weed species. Mulch depth between 2" and 5" to control weed germination without increasing danger from surface fires.
 - Spacing: distance between islands shall be greater than twice the height of tallest shrub or a minimum of 6 feet whichever is greater.
 - Crown cover: approximately 25 - 50% shrub as determined by shrub height and island distribution. (remaining vegetation target: 60% grass & 40% herbaceous)
- ☐ Conversion to lighter fuel types: Spacing requirements to result in Fuel Model #4 Chaparral (Low).
- ☐ Dead to live ratio less than 20%
- ☐ Species diversity:
 - Maintain original diversity of stand.
 - Encourage and protect obligate "seeders." (potentially some species of Manzanita & Ceanothus)
 - Cut "sprouters."
- ☐ Selective removal or thinning to create desired shrub island spacing should:
 - First remove exotic species (such as Himalayan blackberry, pampas grass and French broom). (See *Exotics Shrubs and Perennials* section)
 - Next remove regionally common shrubs that readily resprout should be cut (such as coyote brush, monkey flower, poison oak and sage).
 - Only as last measure to maintain overall species composition should obligate seeds or other species favored for fuel characteristics be thinned or removed (such as ceanothus, oak, bay, huckleberry, snowberry, rose, iris or salal).
- ☐ Grazing Standards: see also grasslands
 - Leave roots.
 - Protect obligate "seeders" from grazing that could girdle shrubs
 - Palatability considerations of targeted shrubs (timing, control methods, stocking etc.)
 - graze less palatable aged materials early in year. Consult with herder to match stock (age, sex, species etc.) with target vegetation.
- ☐ Minimum cover
 - Site specific based on soil stability, species regeneration sensitivity, aesthetics.
 - Function of presence of obligate "seeders."
- ☐ Debris load remaining (see also Grasslands)

1. Debris to remain in place:
Mulch depth between 2" and 5". This is a compromise to allow for weed invasion control while controlling the increased hazard from ground fires.
Standing stems should be no higher than 18" for those species that are cut
Grass areas in mosaic between shrub islands must meet grassland treatment standards
 2. Specifications for chippers / mulch standards: Cut pieces to remain as mulch should be less than 12" in length.
 3. Pile burn: air quality regulations for height and area of piles. Stationary fires may be fed from piles too large to qualify for pile burns.
- ❑ Treatment cycle : Anticipate 5-7 treatment cycle to manage treated areas to standards of Fuel Model #4 Chaparral (Low) with young brush, short mature brush or patchy islands.

Shrub Communities

North Mixed Chaparral



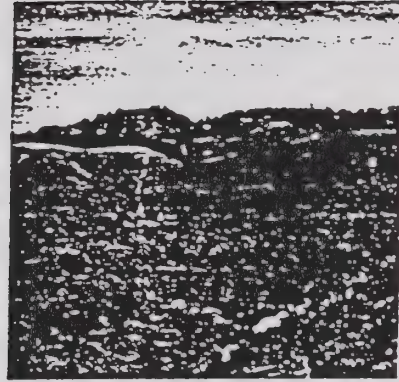
Treatment recommendations are the same for conditions with homes down slope from wildland polygons.

Recommended Actions

- Remove dead materials and litter. Maintain 20% dead to live ratio.
 - Create islands of taller shrubs separated by crushed brush or mulch. See island spacing of North Coastal Scrub. No maximum island size in Chaparral.
 - Anticipated treatment cycle 5-7 years to manage treated areas to standards of Fuel Model #4 Chaparral (Low) with patchy stands that are discontinuous in nature & little litter layer.
- ❖ Note: Treatment in areas of Alameda manzanita to remove dead materials only.

North Coastal Scrub

Dominated by low shrubs that vary in height from 2 to 8 feet (often considered "soft chaparral"). Special scrub types in study area include Coastal Scrub on wet slopes, Coastal Scrub on dry slopes, and Diablan Sage Scrub. Dominant plant species include: Blackberry, Coyote brush, Ceanothus, Huckleberry, Iris, Monkey flower, Poison Oak, Sage, Salal, and Roses.



Dry north coastal scrub is the most common brush community in the study area and can produce dramatic fire behavior.

Primary Fuel Characteristic:

Fire Behavior and Responsiveness to Suppression:

Dry North Coastal Scrub: Overall hazard is rated as highest with flame lengths ranging from 14 to 69 feet depending upon development stage and slope. Dry North Coastal Scrub was modeled as either Chaparral (NFFL model #4) or Brush (model #5).

Wet North Coastal Scrub: Overall hazard is rated as high. It was modeled as Brush (NFFL model #5) with flame lengths ranging from 14 to 32 feet depending upon development stage and slope. Due to the overall moisture levels on the mesic (wet) sites the hazard is downgraded in spite of the potential flame lengths. Flame fronts are difficult to sustain in these sites.

Ignition Potential:

Dry North Coastal Scrub has a high hazard rating with an index of 4. The wet north coastal scrub is rated with an index of 8 as it is typically more difficult to ignite than the dry north coastal scrub due to the general moisture level and typically reduced amounts of dead fuels.

Characteristics

- ◆ More difficult to ignite, but once ignited burns rapidly in dry weather
- ◆ Carries fires from grasses into other larger sized fuel types
- ◆ Moderate to very high heat output
- ◆ Responds more slowly to changes in temperature and moisture than grass (but responds faster than Chaparral).
- ◆ Adapted to natural fire cycle. Most species resprout easily to rejuvenate individual specimen after fire, or require fire to trigger germination.
- ◆ High ratio of dead to live materials during certain stages of life-cycle. Natural life cycle of Coastal scrub includes build up of dead materials in the inside of the shrub that fuels a fire.
- ◆ Dry North Coastal Scrub is a highly aerated fuel when moderately old, sometimes with a discontinuous fuel structure that slows fire spread.

Desired Fire Hazard Reduction Results

- ❖ Shorten overall height of shrubs to decrease chance of carrying fire up into larger plant materials or structures, and to increase the proportion of live material
- ❖ Remove dead materials
- ❖ Remove individual specimens to reduce the overall number of plants & fuel quantity
- ❖ Encourage natural succession to grasslands or woodlands.
- ❖ Two treatments over successive years are more effective than a single treatment.

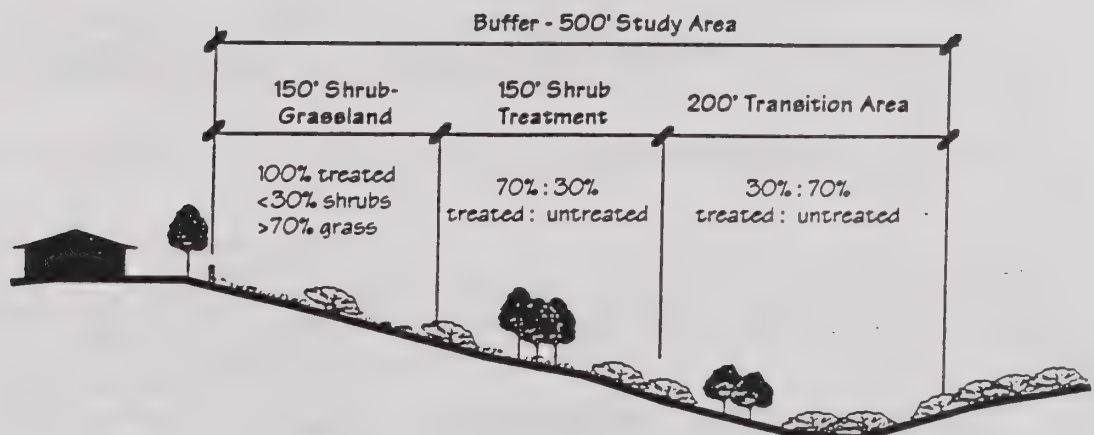
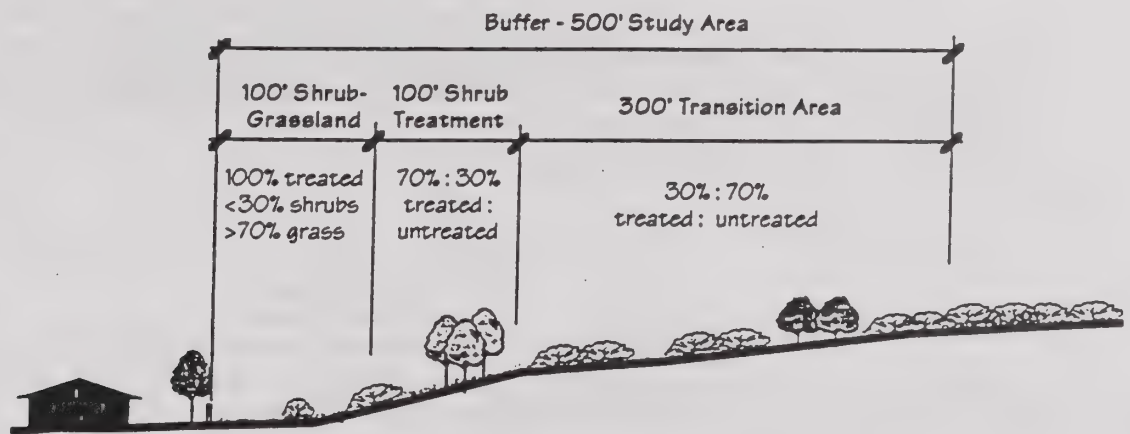
Treatments

Special Considerations

- Potentially the best habitat for the state threatened Alameda whipsnake, which may occur even in small pockets of scrub.
- Effects of fuel management in scrub is not well documented. Monitoring and surveys of plant and animal abundance and community structure following fuel reduction treatments are recommended.
- Timing considerations -- treatment after July 1 will greatly reduce disturbance to seed set of plants and nesting efforts of song birds. Greater limitations to treatment may be required if species of special concern occur in treatment areas.

Shrub Communities

North Coastal and Successional Scrub



Recommended Actions

- Remove dead materials and litter. Maintain 20% dead to live ratio.
- Crush brush to maintain maximum standing height of 3 feet or create islands of taller shrubs separated by herbaceous materials, grass or mulch. See island spacing.
- Anticipated treatment cycle 3-5 years to manage treated areas to standards of Fuel Model #4 Chaparral (Low) with patchy stands that are discontinuous in nature with little litter layer.

Potential Treatment Methods and Limitations

See North Mixed Chaparral

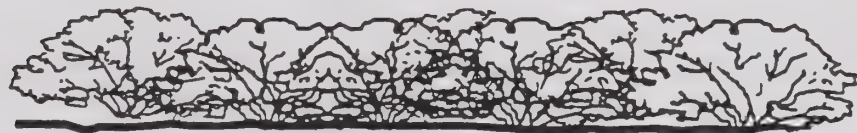
- ✓ **Mechanical:** Mechanical treatment should knock down shrubs or cut off tops. Do not remove entire plant or disturb rootballs. Utilize on slopes under 30% to avoid soil disturbance due to heavy equipment. Operations should be done after approximately July 1 to minimize affects to breeding animals and obligate seeding plant species.

Treatment Performance Standards

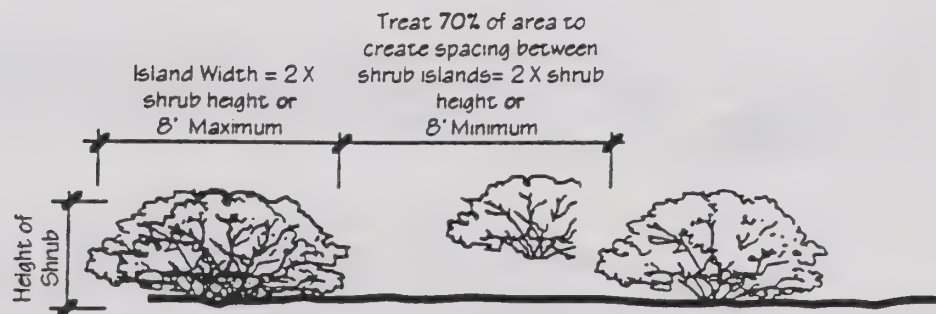
See North Mixed Chaparral

- If knocked down or crushed: maximum height of 3 feet.

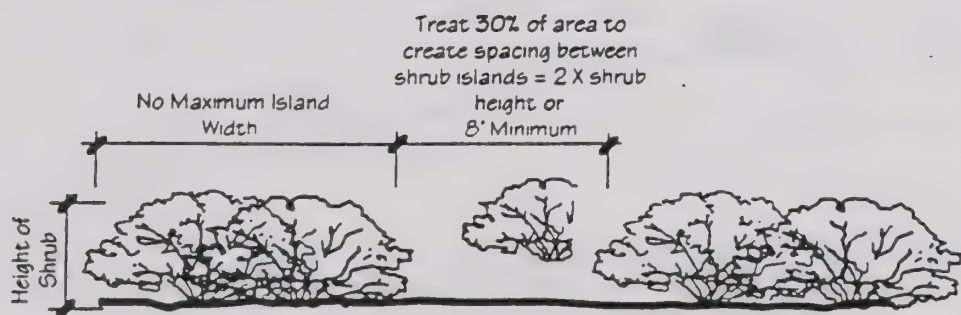
Island Spacing for North Coastal Scrub



Untreated Shrubs



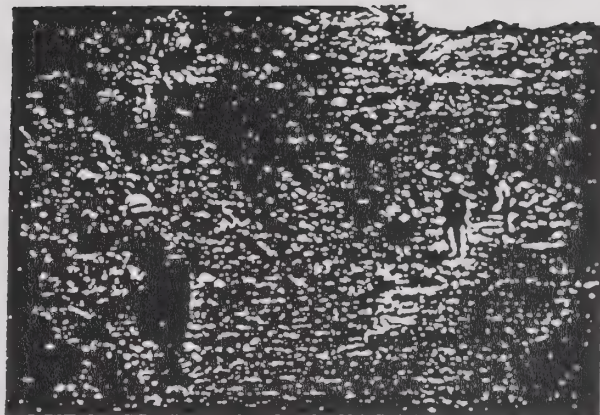
Treated Shrubs



Transition Area

Successional Scrub

Successional scrub describes the stage of natural succession between scrub and one of the forest vegetation types (typically either Oak Woodland or Mixed Hardwood Woodland.) Mix of shrubs, and trees with proportion of each component depending upon stage of natural succession. The extent of the tree component may vary, but will comprise less than 30% cover. Dominant plant species include: annual grasses, Blackberry, Coyote brush, Ceanothus, Huckleberry, Monkey flower, Poison Oak, Sage, California Bay, Scrub Oak, Live Oak.



Manual labor is the most selective of mitigation treatment techniques and is appropriate for many locations in successional scrub to protect emerging tree species.

Primary Fuel Characteristic:

Fire Behavior and Responsiveness to Suppression:

Overall hazard is rated as high with flame lengths ranging from 14 to 32 feet depending upon fuel type, development stage and slope. It was modeled as either Chaparral (NFFL model #4), Brush (NFFL model #5), Timber - Grass (NFFL model #2) or Closed Timber Litter (NFFL Model #8) based on structure, species composition and presence of trees.

Ignition Potential:

Successional Scrub has a high hazard rating with an index of 4.

Characteristics

- ◆ Moderate to very high heat output
- ◆ Overall is slow to respond to changes in temperature and moisture due to vegetation structure and effects of tree canopy. Species present in scrub often respond more rapidly than chaparral species.
- ◆ Adapted to natural fire cycles. Most species resprout easily to rejuvenate individual specimen after fire, or require fire to trigger germination.
- ◆ High ratio of dead to live materials during certain stages of life-cycle. Natural life cycle of Coastal scrub includes build up of dead materials in the inside of the shrub that fuels a fire.
- ◆ As tree canopies shade out shrubs entire shrub carcass remains increasing fuel loading.

Desired Fire Hazard Reduction Results

- ❖ Reduce amount of fine fuels. Shorten overall height of grasses and shrubs to decrease chance of carrying fire up into taller adjacent plant materials or structures, and to increase the proportion of live material
- ❖ Remove dead materials
- ❖ Remove individual specimens to reduce the overall number of plants & fuel quantity
- ❖ Encourage natural succession to woodlands by protecting emerging tree species and reducing fuel ladders formed by surrounding shrubs.

Treatments

Special Considerations

See North Mixed Chaparral, Oak Woodland & Mixed Hardwood Woodland.

- ✱ Decision should be made on a site-by-site basis to either:
 - ✕ encourage succession woodlands,
 - ✕ treat as grassland and prevent successional scrub encroachment, or
 - ✕ hold as a coastal scrub community.

Potential Treatment Methods and Limitations

- ✓ All treatments: Protect tree specimens and encourage development for canopy closure. For trees species over 8' tall, cut out shrubs below driplines and within 6 feet from edge of canopy to create islands of trees. Mulch or permit annual grasses to provide cover between islands. Grasses will need to meet grassland treatment standards. Avoid invasion by exotic weed species with aggressive monitor and treatment program.
- ✓ Alternative treatment is to mow, graze with goats or utilize broadcast burns to revert the area to grasslands and hold succession at that stage.
- ✓ See also North Mixed Chaparral for treatment methods and limitations for shrubs.
- ✓ Hand labor: Hand labor is effective for selective pruning and development of desired spacing. Machinery is often impeded by the numerous small Oaks that should be protected.
- ✓ Mechanical: Mechanical treatment should knock down shrubs or cut off tops. Do not remove entire plant or disturb rootballs. Utilize on slopes under 30% to avoid soil disturbance due to heavy equipment. Operations should be done after approximately July 1 to minimize affects to breeding animals and obligate seeding plant species.

Treatment Performance Standards

See North Mixed Chaparral, Oak Woodland & Mixed Hardwood Woodland.

- If knocked down or crushed: maximum height of 3 feet.

Exotic Shrubs and Perennials

Dominated by exotic shrubs, perennials and forbs introduced to the Bay Area and often considered "weed species". Species in the study area include: French or Scotch Broom, Thistle, Acacia, Himalayan Blackberry, Pampas Grass.



Pampas grass and broom, common exotic shrubs, are invasive especially in disturbed sites. Treatments must include subsequent control of these species.

Primary Fuel Characteristic:

Fire Behavior and Responsiveness to Suppression

Overall hazard is rated as high. Flame lengths of 15 to 18 depending on vegetation type, development stage and slope. Both Acacia and French Broom were modeled as separate vegetation types either as Hardwood litter (NFFL model # 9) or Brush (NFFL model #5).

Ignition Potential

Both Acacia and French Broom have a moderate ignition potential with an index of 6. The ignition potential can be greatly increased with the presence of other exotic species such as Pampas Grass that has a high proportion of fine fuels or dead materials.

Characteristics

- ◆ Moderate ignition, but once ignited spreads rapidly
- ◆ Carries fires from grasses into other larger sized fuel types
- ◆ Moderate to very high heat output
- ◆ Responds more slowly to changes in temperature and moisture
- ◆ Some species have oils, resins or other volatile chemicals that make them burn faster and hotter
- ◆ Highly invasive and very difficult to eradicate. Competes with native vegetation and responds best to disturbed sites.
- ◆ Adapted to natural fire cycle. Most species resprout easily to rejuvenate individual specimen after fire, some depend on fire to promote germination or clear site of competitors and create ideal situations for growth.

Desired Fire Hazard Reduction Results:

- ❖ Shorten overall height of shrubs or forbs to decrease chance of carrying fire up into taller adjacent plant materials or structures.
- ❖ Difficult to remove once established. Utilize techniques that minimize their successful reproduction and establishment.
- ❖ Reduce potential ignition sites (such as along roadsides, picnic areas, overlooks)
- ❖ Convert exotics to more fire safe vegetation type.

Treatments

Special Considerations

- ✱ Removal of any and all of this vegetation is ecologically desirable provided it does not result in increased erosion or harm nearby vegetation during treatment.

Potential Treatment Methods and Limitations

- ✓ All methods: Repeated treatments are usually necessary for successful conversion. Best success often utilizes a combination of treatments. Any disruption in treatment cycle (i.e. skipping a growing season) usually results in return to dominance of exotics and may actually increase the size and density of population.
- ✓ Hand Labor: Not effective unless root is removed. Prolific seed banks of most exotics reduces effectiveness due to rapid re-invasion of targeted species.
- ✓ Utilize mulch to reduce invasion of exotic species.
- ✓ Grazing (goats): Effective to reduce standing fuels in broom or thistle. Does not reduce re-invasion. Does not appear effective in pampas grass (goats will not browse) or acacia (browse stimulates subsequent sprouting).
- ✓ Prescribed Burn: Use in conjunction with mechanical or manual cutting to reduce re-invasion of broom by reducing seed bank. (Cut in late summer or fall and burn following spring).
- ✓ Mechanical: Cut broom prior to seed production. Procedures must be incorporate to prevent spreading seeds of noxious species. This includes cleaning of equipment blades, tracks and undercarriage prior to working new sites.
- ✓ Chemical: Treatment of last resort due to public/ environmental concerns. Limited data and generally a low success rate recorded with existing licensed products on highly invasive species. Some success in current research with direct application basal bark treatment on French Broom.

Treatment Performance Standards

Often intermixed with other vegetation communities. See standards for Grassland, North Mixed Chaparral, Oak Woodland & Mixed Hardwood Woodland. More detailed management of French broom being done at Lawrence Berkeley Laboratory.

- ☐ Special considerations to reduce re-introduction of exotics
 - ✗ Leave mulch and or seed with grass to reduce bare earth after treatment
 - ✗ Incorporate best management practices into treatment operation to reduce spread of seed. Practices to include equipment cleaning, feed restrictions, adequate residual dry matter and seasonal restrictions.
 - ✗ Timing of treatment critical for best results.

Mature Eucalyptus Forest

Large stands were planted in the study area in the early 1900s. Developed into dense plantations of approximately 1,000 stems per acre (trees spaced approximately 7 feet apart). Dominant species are blue gum, and to a lesser extent red gum. Understory plant diversity is usually poorly developed, consisting mainly of young Eucalyptus with annual grasses at edges of stands. Edges also are often mixed with other introduced species such as acacia and Monterey pine.



Mature Eucalyptus forests with widely spaced single trunks and little ground litter (left) represent a lower fire hazard than the multiple stem second growth.

Primary Fuel Characteristic:

Fire Behavior and Responsiveness to Suppression

Overall rating is high with flame lengths ranging from 6 to 21 depending upon development stage and slope. The wide variety of flame lengths primarily relates to depth of litter below trees, amount of dead materials within tree, stand density and understory. The mature eucalyptus was modeled as either Timber Litter Understory (NFFL model #10), Brush (NFFL model #4), Hardwood litter (NFFL model #9) or Closed timber Litter (NFFL model #8).

Ignition Potential

Highest hazard rating due to presence of fine fuel, especially in areas with deep build-up of litter, and dead materials. Ignition index of 1.

Characteristics

- ◆ Ignition can occur almost year round.
- ◆ Presence of volatile oils increase speed of fire spread, total heat output and ignitability
- ◆ Ignited leaves and bark easily carried airborne, increases potential for starting new fires long distances from fire (spotting). Size of leaves and bark large enough to ensure ember is still viable (versus small particles that could be extinguished in flight).
- ◆ Heat output high when fuel has accumulated
- ◆ Large limbs respond more slowly to changes in temperature and moisture. Preponderance of fine fuels (leaves, loose bark, small twigs) respond more rapidly.
- ◆ Susceptible to freeze damage and insect attacks which increases the ratio of dead to live fuels.

- ◆ Adapted to natural fire cycle. Ability to rejuvenate through stump sprouting makes it difficult to remove.
- ◆ Fastest & heaviest accumulator of fuels.

Desired Fire Hazard Reduction Results:

- ❖ Create vertical separation between tree canopy and surface fuels below (including young trees).
- ❖ Remove dead materials and decrease duff layer
- ❖ Remove loose bark.
- ❖ Create large separation between groupings of trees to slow rapid fire spread from crown to crown.
- ❖ Remove specimens (to reduce fire spread through spotting such as on ridge tops or near urban interface)
- ❖ Thin stand to reduce overall fuel production.
- ❖ Convert to more fire safe vegetation type. Avoid moving towards Second Growth Eucalyptus.

Treatment

Special Considerations

In general, Eucalyptus forest is a non-native vegetation type which supports a low diversity of understory plant species. Replacement by hardwood forest (the most likely vegetation type) is generally desirable, though the transition can be disruptive. Careful planning can minimize and shorten the adverse effects.

- Raptors may use Eucalyptus forest for nesting. Periodic surveys would reveal the presence of nesting pairs. Major treatments (such as prescribed burning, logging or chemical treatments) in the vicinity of known nesting pairs should be postponed until young have fledged. Species of special concern include Cooper's hawk, sharp-shinned hawk and golden eagle.
- Great Blue Herons are known to nest in the vicinity of Eucalyptus forest near Lake Chabot. EBRPD wildlife staff should be consulted prior to major activity in this area.
- Monarch Butterflies are known to winter in colonies in Eucalyptus forest; however, this is in very isolated areas and is commonly near the coast. There are no known monarch butterfly wintering areas in the Study area.
- Eucalyptus trees in a sparse stand can serve as a nursery site for Oaks and Bays, providing some shelter from sun and wind. While Eucalyptus would not be utilized deliberately in this way, special treatment of a stand could permit removal of the eucalyptus while protecting the Oaks and Bays.
- Fog drip from Eucalyptus is a local phenomena that can encourage the growth of understory species. However, restoration to indigenous species is the ultimate goal.
- Hummingbirds depend on Eucalyptus blossoms for winter nectar. Mitigation may include planting currants and other winter blooming shrubs to offset food loss.

Potential Treatment Methods and Limitations

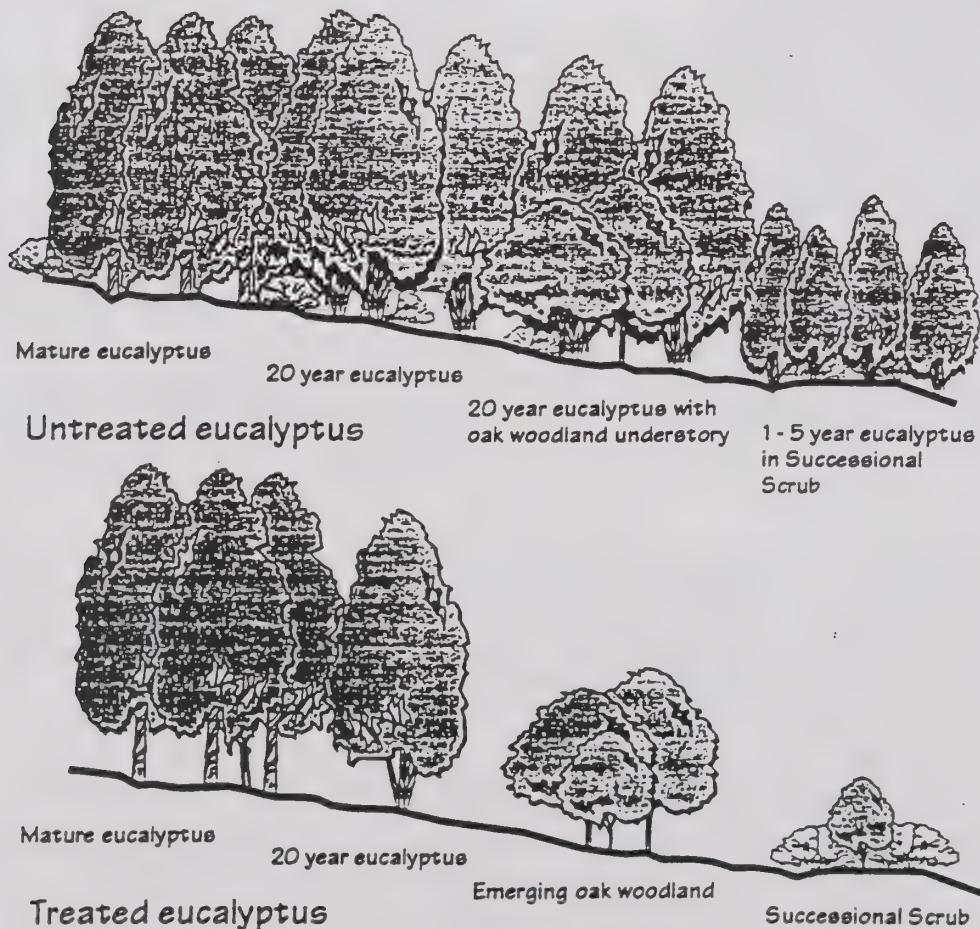
- ✓ Hand Labor: Effective for removal of litter below trees removal of loose bark and other treatment prior to treatment with prescribed fire. Effective for removal of lower branches, selective thinning of stands by removal of smaller trees in well-established stands, and on sites too steep for equipment or with other special considerations. Haul routes planned for removal of cut trees must minimize adverse impacts.
- ✓ Prescribed burn: Effective for removal of litter build-up. Requires use of other methods to prepare stand prior to safe use and to prevent crowning. Intermixed Oaks and Bays should be protected.

- ✓ **Mechanical:** Utilize on slopes under 30% to avoid adverse effects due to heavy equipment. Haul routes planned for removal of cut trees must minimize impacts.
- ✓ **Chemical:** Follow-up treatment utilized to reduce resprout following cutting. Monitoring of response and additional treatments are critical to prevent stump sprouting. Effectiveness is dependent on herbicide and practices utilized.

Treatment Performance Standards

- ☐ Separation of fuel (structure)
 - ✗ Provide 10' vertical clearance between lowest branches and ground.

Eucalyptus Forest



Recommended Actions

- Reduce litter depth and dead material on ground to less than 9 tpa.
- Remove all fuel ladders to 10' height including loose bark, dead limbs and young trees <12" dbh.
- Maintain canopy closure where practical to reduce exotic weed invasion.
- Stand density reduction to focus on removal of aged, damaged, structurally unsound or otherwise hazardous individuals.
- Monitor all cut stumps to eliminate stump sprout on an annual basis.
- Management actions of second growth must favor 20 year eucalyptus or oak woodland understory.
- Remove 1 - 5 year eucalyptus and manage to prevent resprout.
- Anticipate 2 to 3 year treatment to manage productive areas to standards of Fuel Model #8 Closed Timber Litter, Model #9 Hardwood Litter (Moderate), or Model #10 Timber Litter Understory (Low) with shallow litter layers, no fuel ladders, and only occasional jackpots of fine fuels or logs over 3" diameter.

- ✗ Remove loose bark up to 10' from ground.
- ✗ Remove understory trees and tall shrubs
- ☐ Dead-fuel : under 9 tons/acre (t/a) - 3 year rotation
- ☐ Stand density :
 - Maintain canopy closure to prevent understory development.
 - ✗ Remove all trees under 12" dbh (the young, shorter trees that are located beneath the major canopy that create fuel ladders into mature trees)
 - ✗ Control resprout of cut stumps.
 - ✗ Control and eliminate all suckering
- ☐ Management of fuel load: Do not convert. Manage as mature eucalyptus grove to maintain fuel load and eliminate vertical continuity.
- ☐ Species diversity:
 - ✗ Maintain as mature, even-aged single-species stand.
 - ✗ Removal & replacement issues will need to be addressed as stand ages.
- ☐ Debris load remaining (see also Grasslands)
 - ✗ 2" maximum depth of duff or mulch
 - ✗ Remove or chip all materials less than 4" diameter. Cut materials greater than 4" diameter into firewood.
 - ✗ To feed into chipper: Maximum length 6'. Maximum diameter 4".
- ☐ Treatment cycle: Anticipated 2 to 3 year cycle to maintain standards of Fuel Model #8 Closed Timber Litter, Model #9 Hardwood Litter (High) or Model #10 Timber Litter Understory (low).

Second Growth & 1 to 5 year old Eucalyptus Forest

These Eucalyptus forests are the results of the re-growth of previous cut mature Eucalyptus. The category includes relatively small young specimens from 1 year to 5 years of age, as well as what appears to be "mature" trees of up to 20 years old. Understory diversity is often mixed with Oaks, Bays, Pines, as well as exotic shrubs or chaparral. Edges also are often mixed with other introduced species such as Acacia and Monterey Pine. The forest is dominated by trees with multiple trunks and larger amount of leaves at the lower levels. More hazardous than Mature Eucalyptus Forest due to understory and multiple stems.



Second growth Eucalyptus forests characterized by multiple trunks, ladder fuels and large quantities of fine materials present high risks of ignition, fire spread and spotting.

Primary Fuel Characteristic:

Fire Behavior and Responsiveness to suppression:

Overall rating is high with flame lengths ranging from 7 to 31 depending upon development stage and slope. The wide variety of flame lengths primarily relates to depth of litter in and below trees, amount of dead materials within tree, stand density and understory. The second growth eucalyptus was modeled as either Brush (NFFL model #4), Timber Litter Understory (NFFL model #10), Hardwood litter (NFFL model #9) or Timber Grass (NFFL model #2). The

1 to 5 year old eucalyptus was modeled as Southern Rough (NFFL model #7), Timber Litter Understory (NFFL model #10), or Hardwood litter (NFFL model #9).

Ignition Potential

Highest hazard rating, especially in areas with deep build-up of litter, and dead materials.

Ignition index of 1 for second growth and 2 for one to five year old trees where not as much litter is present. Often easy for fire to move up into the crown due to understory and continuity of fuels caught in between multiple stems.

Characteristics:

- ◆ Ignition easier than in mature forest due to more smaller sized and surface level fuels and more sunlight to dry the ground fuels.
- ◆ Presence of volatile oils increase spread of fire spread
- ◆ Ignited leaves and bark easily carried airborne, increases potential for starting new fires long distances from fire (spotting). Size of leaves and bark large enough to ensure ember is still viable (versus small particles that could be extinguished in flight).
- ◆ Heat output high
- ◆ Large limbs respond more slowly to changes in temperature and moisture. Preponderance of fine fuels (leaves, loose bark, small twigs) respond more rapidly.
- ◆ Susceptible to freeze damage and insect attacks which increases the ratio of dead to live fuels.
- ◆ Adapted to natural fire cycles. Ability to rejuvenate through stump sprouting makes it difficult to remove individual specimens.
- ◆ Multiple trunks elevate dead material, making fire burn hotter.

Desired Fire Hazard Reduction Results:

- ❖ Create vertical separation between tree canopy and surface fuels below (including other species).
- ❖ Remove dead materials and decrease duff layer
- ❖ Remove loose bark.
- ❖ Reduce number of stems per tree
- ❖ Create separation between large groupings of trees to slow rapid fire spread from crown to crown.
- ❖ Where feasible eliminate vegetation type. Remove specimens on ridge tops or near urban interface to reduce fire spread through spotting. Convert to more fire safe vegetation type.

Treatment

Special Considerations

Older stands of second growth Eucalyptus are likely have the same considerations as the Mature Eucalyptus. These forest may exhibit a more diverse understory or larger number of intermixed native hardwoods that should be protected and encouraged.

Young or small stature Eucalyptus stands do not have the same special considerations as the mature specimens with respect to raptors, great blue herons or monarch butterflies. The potential benefit as nursery site for native hardwood forests may also be diminished. In sum, there is little ecological reason to protect these Eucalyptus stands. However, where the young Eucalyptus are intermixed with native hardwoods (Oak and Bay), caution should be exercised to conserve the native species.

Potential Treatment Methods and Limitations

- ✓ Hand Labor: Effective for removal of resprouts, litter below trees, removal of lower branches or loose bark and other treatment prior to treatment with prescribed fire. Effective for selective thinning of stands by removal of trees or stems on sites too steep for equipment or with other special considerations. Haul routes planned for removal of cut trees must minimize adverse impacts.
- ✓ Prescribed burn: Effective for removal of litter build-up. Requires use of other methods to prepare stand prior to safe use and to prevent crowning. More difficult to use in second growth than in mature stands.
- ✓ Mechanical: Eliminate stumps of cut trees to facilitate use of machinery to mow grass or brush. Utilize on slopes under 30% to avoid adverse effects due to heavy equipment. Haul routes planned for removal of cut trees must minimize adverse impacts.
- ✓ Chemical: Follow-up treatment utilized to reduce resprout following cutting. Monitoring of response and additional treatments are critical to prevent stump sprouting. Effectiveness of Glyphosate seems to be seasonal (summer/fall giving best results).

Treatment Performance Standards

- ☐ Separation of fuel (structure)
 - ✗ On trees greater than 30' in height, provide 10' vertical clearance between lowest branches and ground.
 - ✗ Remove loose bark up to 10' from ground.
 - ✗ Remove all shrubby or 1-5 year old eucalyptus < 12" dbh (aggregate of all stems).
- ☐ Dead-fuel : under 9 tons/acre (t/a) - 3 year rotation
- ☐ Stand density: Maintain as mature, even-aged single-species stand. Thin multiple stems and remove trees to reduce stems per acre. Select for single stem & smaller specimens to establish 20' spacing through stand. Encourage canopy closure.
- ☐ Conversion to lighter fuel types:
 - ✗ Convert to native, "historical" vegetation type (grass or woodland)
 - ✗ Continued monitoring and control required to prevent regrowth
 - ✗ On sites susceptible to land slides, a geotechnical evaluation must be made on a case-by-case basis to determine the contribution of the root mass to deter mass slippage and potential impacts of conversion.
- ☐ Species diversity:
 - ✗ If stand is being retained as eucalyptus: Remove all understory that provides fuel ladder into eucalyptus canopy. Manage to even age stand. Removal & replacement issues of eucalyptus will need to be addressed as stand ages.
 - ✗ If stand is being converted to oak woodland: Maintain some eucalyptus as shade/wind shelter nursery trees as required to shelter emerging understory. Retain diversity of understory if conversion is desired.
- ☐ Debris load remaining
 - ✗ 2" maximum depth of duff or mulch
 - ✗ Remove or chip all materials less than 4" diameter. Cut materials greater than 4" diameter into firewood.
 - ✗ To feed into chipper: Maximum length 6'. Maximum diameter 4".
- ☐ Treatment cycle: Anticipated 2 to 3 year cycle to maintain standards of Fuel Model #8 Closed Timber Litter, Model #9 Hardwood Litter (High) or Model #10 Timber Litter Understory (low).

Monterey Pine Forest - Mature & Plantations

Introduced in large plantations to the Bay Area from their native range in the early 1900s. Understory diversity is sometimes poorly developed, consisting mainly of young pines with annual grasses at edges of stands. Other more open stands have a well developed understory of Oaks, Bays, Poison Oak and Blackberry with an intermix of Cypress. Edges also are often mixed with other introduced species such as Acacia and French Broom. Does not resprout once cut.



Monterey Pines in the Study Area vary in age, but many are old and diseased (left) increasing fire hazards.

Primary Fuel Characteristic:

Fire Behavior and Responsiveness to Suppression

Overall hazard is rated as moderate to high. Flame lengths of 2 to 16 depending upon understory conditions, development stage and slope. Pine forests were modeled as Timber Litter Understory (NFFL model #10), Hardwood litter (NFFL model #9), Timber Grass (NFFL model #2) or Closed Timber Litter (NFFL model #8).

Ignition Potential

Highest hazard rating with an index of 2 for both plantations and mature groves. Presence of needles, hazardous understory and fine dead wood on ground and in lower portions of trees increases ignition potential.

Characteristics

- ◆ Relatively easy to ignite if tall grass groundcover or build up litter (needles, and branches). More difficult to ignite crowns of mature trees if these fuels do not exist. Heat output and spread linked to fuel build-up and litter.
- ◆ Presence of volatile resins increase heat and spread of fire spread
- ◆ Ignited needles and branches easily carried airborne, increases potential for starting new fires (spotting)
- ◆ Heat output high when fuel has accumulated
- ◆ Large limbs respond more slowly to changes in temperature and moisture. Preponderance of fine fuels (needles and small twigs) respond more rapidly.
- ◆ Majority of plantations are aged and more susceptible to insect attacks which increases the ratio of dead to live fuels.
- ◆ Fast accumulator of fuels.
- ◆ Adapted to frequent low-intensity of fires.

Desired Fire Hazard Reduction Results:

- ❖ Create vertical separation between tree canopy and surface fuels below (including short trees).
- ❖ Remove dead materials and decrease duff layer
- ❖ Create separation between groupings of trees to slow rapid fire spread from crown to crown.
- ❖ Remove specimens on ridge tops or near urban interface to reduce fire spread through spotting.
- ❖ Thin stand to reduce overall rate of fuel production

- ❖ Encourage replacement to more fire safe vegetation type (such as Oak Woodland, Redwood or short needled Pines.)

Treatments

Special Considerations

Since Monterey Pine Forest is a non-native vegetation type, its conservation as a natural community is of low concern from an ecological viewpoint. Open stands tend to support a native understory, but there are no records of species of special concern to suggest special management requirements. Possible concern if raptor nesting occurs in this type. However, the aesthetic value and social attachment to these forests will require sensitive and well publicized management treatments.

Potential Treatments and Limitations

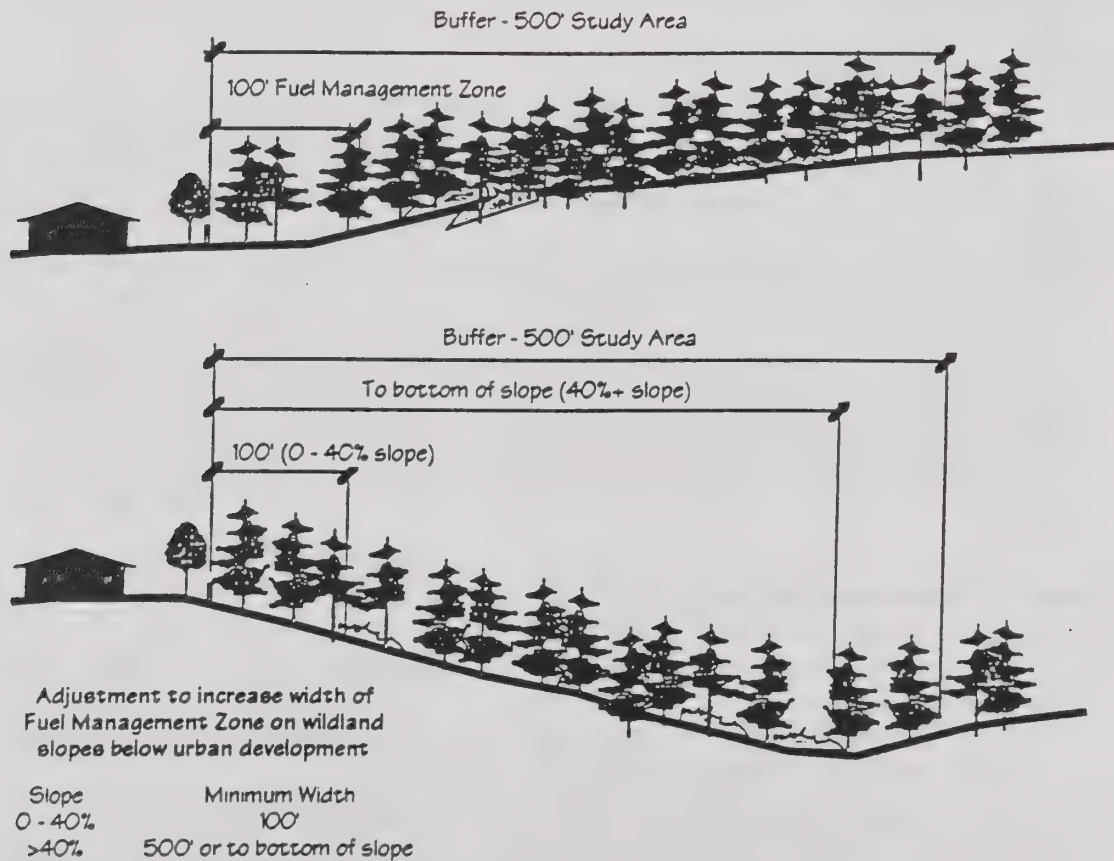
- ✓ Hand Labor: Effective for removal of litter below trees, dead limbs and other treatment prior to prescribed burning. Effective for removal of lower branches, selective thinning of stands by removal of trees on sites too steep for equipment or with other special considerations. Haul routes planned for removal of cut trees must minimize adverse impacts.
- ✓ Grazing: Goat grazing of understory materials must include protection of understory Oak trees to prevent girdling or depletion.
- ✓ Prescribed burn: Pile or stationary burns are effective for removal of dead limbs or other materials gathered by hand. Low intensity broadcast burns are effective for removal of litter build-up; easy to burn when grass is green. Requires use of other methods to prepare stand prior to safe use and to prevent crowning.
- ✓ Mechanical: Utilize on slopes under 30% to avoid adverse effects due to heavy equipment. Haul routes planned for removal of cut trees must minimize adverse impacts.

Treatment Performance Standards

- ☐ Separation of fuel (structure)
 - X 10' vertical clearance between live needles and understory fuel. Remove all dead material.
 - X Prune branches up to 3" in diameter. Prune up a maximum of 1/3 height for trees that are not taller than 24' tall.
- ☐ Dead-fuel : under 5 tons/acre (t/a). Depth of duff no greater than 2 inches
- ☐ Stand density: Maintain as mature, single species even-aged stand where possible. Density function of diameter of trees. Leave all trees over 8" dbh. Leave 1/3 of trees under 8" to retain a range of size categories and species. Maximum density of 100 stems per acre (approximately 20' spacing).
- ☐ Conversion to lighter fuel types: Manage as single species pine forest; do not convert to lighter fuel types.
- ☐ Maximum removal of live materials: Maintain canopy cover to discourage invasion of brush and exotic weed species.
- ☐ Species diversity: Manage as even-aged, closed canopy stand. Remove understory that create fuel ladders.
- ☐ Grazing standards: Protect individual understory specimens from browse and girdling.
- ☐ Debris load remaining (see appropriate treatment standards for grass or shrub understory)
 - X Debris to remain in place: see brush.
 - a) Mulch or dispose off site all slash.

- b) Cut logs greater than 4" diameter to firewood lengths.
- X Specifications for chippers / mulch standards
 - a) To feed into chipper: Maximum length 6'. Maximum diameter 4".
 - b) Maximum mulch depth: 2"
- Treatment cycle: Anticipated 7 to 10 year cycle in closed canopy stand to maintain standards of Fuel Model #2 Timber Grass (Low) or Fuel Model #9 Hardwood Litter (High). Locations with high ignition potential will need more frequent treatment to reduce fine surface fuels.

Monterey Pine Community

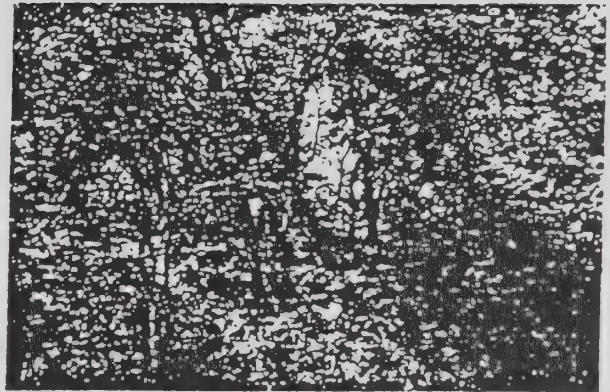


Recommended Actions

- Reduce litter depth and dead material on ground to less than 5 tpa.
- Remove all fuel ladders to 10' height including loose bark, dead limbs and young trees < 8" dbh.
- Maintain canopy closure where practical to reduce exotic weed invasion.
- Stand density reduction to focus on removal of aged, damaged, structurally unsound or otherwise hazardous individuals.
- Anticipate 5-7 year treatment to manage productive areas to standards of Fuel Model #2 Timber Grass (Low) or Model #9 Hardwood Litter (Moderate) with shallow litter layers, no fuel ladders and only occasional jackpots of fine fuels.

Mixed Hardwood Woodlands & Forests

Mix of tree species including Coast Live Oak, California Bay, Black Oak or Madrone, which reach 30 to 50 feet in height. Mixed Hardwood Woodlands have from 30% to 70% shrub understory and includes many of the species seen in successional scrub (including native Elderberry, Currants, Sumacs, or Toyon). Understory is rarely annual grasses. Mixed Hardwood Forests typically include little shrub understory and have greater than 70% canopy closure. Fuel characteristics are primarily dependent on the amount and structure of the understory (often Poison Oak), or the relationship of the trees to the shrubs and groundcovers.



Mixed hardwood woodlands typically include a dense brush layer that should be reduced to improve fire safety.

Primary Fuel Characteristic: Fire Behavior and Responsiveness to Suppression

Overall hazard is rated as high due to presence of understory. Flame lengths range from 1 to 34 depending upon presence of understory, development stage and slope. Fire behavior is similar to successional scrub where that type of understory is present, with the additional potential of crown fires. Without understory, fire behavior is fairly benign. Woodlands were modeled as Chaparral (NFFL model #5), Brush (NFFL model #4), Timber litter understory (NFFL model #10), Hardwood litter (NFFL model #9), Timber Grass (NFFL model #2) or Closed timber litter (NFFL model #8) depending on its structure, species and presence of understory. Forests were modeled as Closed timber litter (NFFL model #8).

Ignition Potential:

Ignition potential is dependent on understory vegetation, but is usually rated as moderate hazard due to the moderating effects of canopy cover. Typical ignition index is 6 but may be reduced to 8 where canopy has closed and understory has few shrubs or little litter buildup.

Characteristics:

- ◆ Ignition dependent upon build-up of surface fuels, behavior is dependent on ladder fuels (including low hanging branches) that carry fire into Oak canopy. Relatively easy to ignite if tall grass groundcover and build up of dead material in shrubs. Difficult to ignite if these fuels do not exist (or if live materials are pruned far off the ground) as the live leaves are relatively fire resistant.
- ◆ Treatment cycle: Anticipated 2 to 3 year cycle to maintain standards of Fuel Model #8 Closed Timber Litter, Model #9 Hardwood Litter (High) or Model #10 Timber Litter Understory (low).
Heat output high if understory is well developed.
- ◆ Responds more slowly to changes in temperature and moisture where grasses are absent.
- ◆ Naturally adapted to frequent low intensity fires (such as through understory grasses).

Desired Fire Hazard Reduction Results:

- ❖ Create vertical separation between tree canopy and surface fuels below.
- ❖ Remove dead materials

- ❖ Encourage dense, healthy canopy to shade out more flammable understory and exotic species
- ❖ Reduce amount of fuel in understory
- ❖ Encourage natural succession of Woodland to Forest.

Treatments

Special Considerations

A number of species of special concern occur in Mixed Hardwood Woodlands and Forests, often at the edges bordering brush and grassland. Inventories of woodland and forest areas are recommended prior to fuel management, especially prior to the initial treatment. (see also Grasslands and Brush & Shrub Dominated Communities considerations).

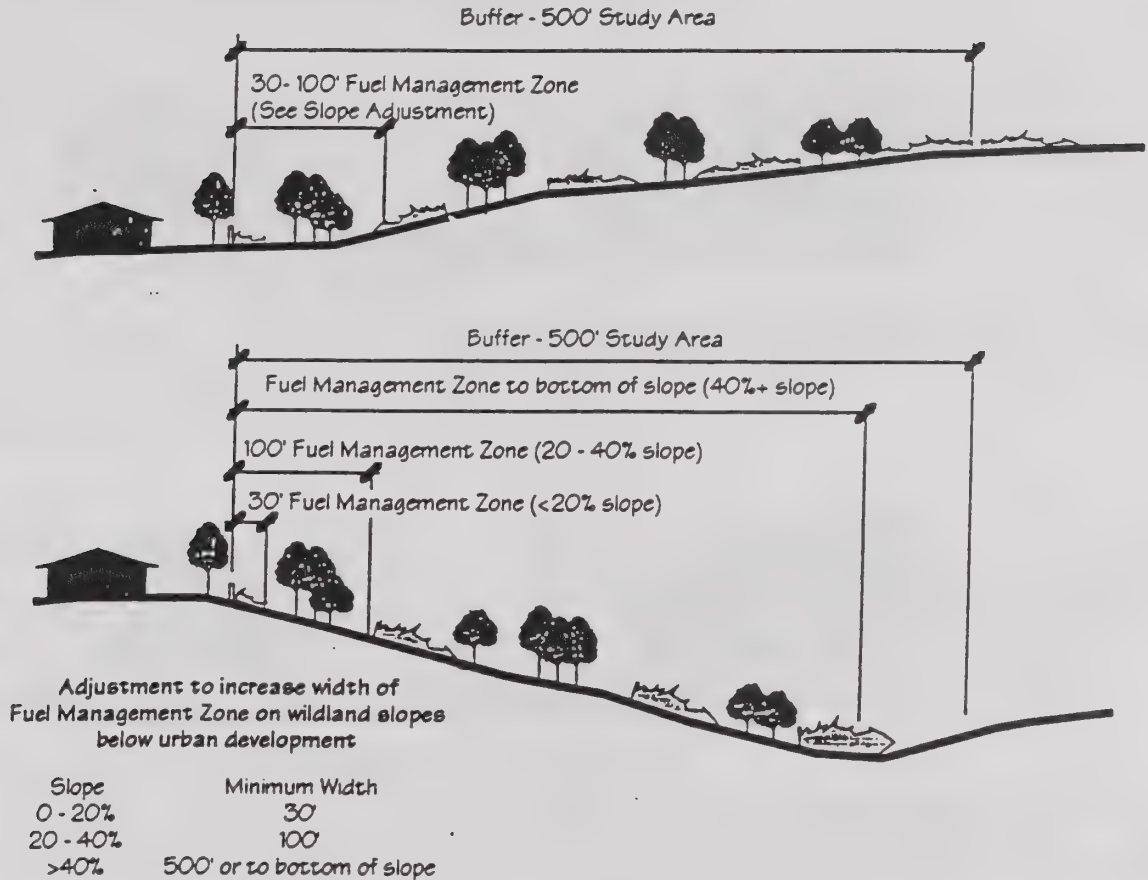
Potential Treatments and Limitations

- ✓ Hand Labor: Effective for removal of litter below trees, lower branches, dead limbs and other treatment prior to treatment with prescribed fire. Effective for selective thinning of stands by removal of trees or stems on sites too steep for equipment or with other special considerations. Haul routes planned for removal of cut trees must minimize adverse impacts.
- ✓ Grazing: Goat grazing of understory materials must include protection of trees to prevent girdling and of species of special concern.
- ✓ Prescribed burn: Pile or stationary burns are effective for removal of dead limbs or other materials gathered by hand. Requires use of other methods to prepare stand prior to safe use and to prevent crowning.
- ✓ Mechanical: Not commonly used because of numerous tree trunks, but may be suitable to reduce brush encroachment depending on stand structure. Utilize on slopes under 30% to avoid adverse effects due to heavy equipment. Haul routes planned for removal of cut trees must minimize adverse impacts.

Treatment Performance Standards

- ☐ Separation of fuel (structure)
 - ✗ 8' vertical clearance between live foliage and understory fuel. Remove all dead material.
 - ✗ Prune branches up to 3" in diameter. Prune up a maximum of 1/3 height for trees that are not taller than 24' tall.
- ☐ Dead-fuel : under 5 tons/acre (t/a). Depth of duff no greater than 2 inches
- ☐ Stand density: Encourage and maintain canopy closure of emerging tree species. See
- ☐ Conversion to lighter fuel types: Do not convert to lighter fuel types.
- ☐ Maximum removal of live materials: Maintain canopy cover.
- ☐ Species diversity: Maintain and encourage species diversity of trees and shrubs (in the interspace between trees); manage for understory of low herbaceous material below canopy.
- ☐ Selective removal or thinning should:
 - First remove exotic species in understory (such as Himalayan blackberry, pampas grass and French broom).
 - Next remove regionally common shrubs that readily resprout should be cut (such as coyote brush, monkey flower, poison oak and sage).
 - Only as last measure to maintain overall species composition should obligate seeds or other species favored for fuel characteristics be thinned or removed (such as ceanothus, oak, bay, huckleberry, snowberry, rose, iris or salal).

Hardwood Woodland Communities



Recommended Actions

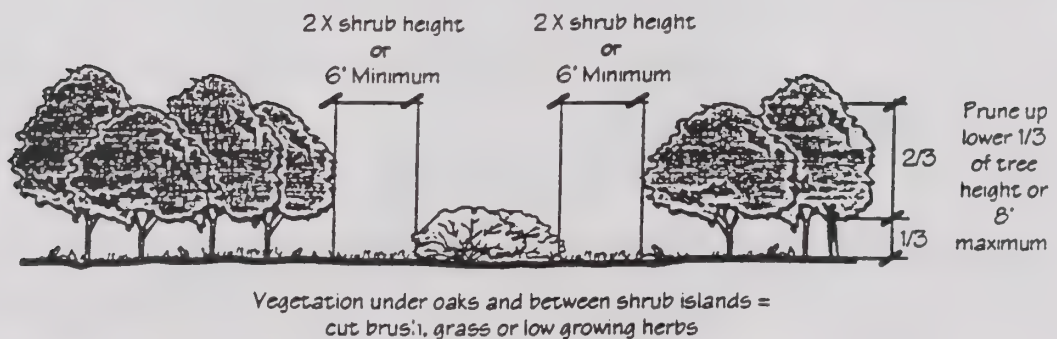
- Remove dead materials and litter within woodland.
- Encourage canopy closure of overstory tree species. Crush or remove brush to maintain separation between ground cover and crown of trees. See Understory Clearing.
- Anticipated treatment cycle 5-7 years to manage treated areas until canopy closure is achieved to standards of Fuel Model #8 Closed Timber Litter or Model #9 Hardwood Litter (Moderate) with shallow litter layers, no fuel ladders and only occasional jackpots of fine fuels.

- ☐ Grazing standards: Protection of individual specimens from browse and girdling.
- ☐ Debris load remaining (see appropriate treatment standards for grass or shrub understory)
 - ☒ Debris to remain in place: see brush.
 - a) Mulch or dispose off site all slash.
 - b) Cut logs greater than 4" diameter to firewood lengths.
 - ☒ Specifications for chippers / mulch standards
 - a) To feed into chipper: Maximum length 6'. Maximum diameter 4".
 - b) Maximum mulch depth: 2"
- ☐ Treatment cycle : When emerging woodland is in early stages anticipate 3-5 treatment cycle to manage treated areas to standards of Fuel Model #4 Chaparral (Low) with young brush, short mature brush or patchy islands among emerging oak bay woodland. Treatment cycle will decrease as trees mature and canopy closes to an anticipated 7 to 10 years interval. Manage closed canopy to standards of Fuel Model #8 Closed Timber Litter or Model #9 Hardwood Litter (High).

Understory Clearing



Untreated Shrubs under Oaks



Treated Shrubs under Oaks

Redwood Forest

Dominated by Coast Redwood which reaches 75 to 150 feet height. In the study area this is usually a narrow zone along perennial creeks, drainage swales, canyons or on north or east exposures where the moisture level is higher. Understory is usually sparse and consists largely of Bay trees, ferns and Oxalis. Redwood forest may be intermixed with Riparian Forest and include planted Cypress. In general this vegetation type represents a low fire concern and can be beneficial.



Redwood Forests represent relatively low fire hazards in the Study Area.

Primary Fuel Characteristic: Fire Behavior and Responsiveness to Suppression:

Overall hazard is rated as low with flame lengths ranging from 2 to 7 feet depending upon development stage and slope. Redwood forests were modeled as Hardwood litter (NFFL model #9) and Closed Timber litter (NFFL model #8).

Ignition Potential:

Ignition potential is low due to moisture levels with an index of 8.

Characteristics:

- ◆ Ignition dependent upon build-up of surface fuels and ladder fuels that carry fire into Redwood canopy. Usually difficult to ignite canopy, however natural litter (or duff) is somewhat flammable and will smolder creating a fire that is difficult to fully extinguish.
- ◆ Once large fuels ignite heat output is high though fire burns slowly.
- ◆ Responds more slowly to changes in temperature and moisture

Desired Fire Hazard Reduction Results:

- ❖ Encourage dense, healthy canopy to shade out flammable understory and exotic species
- ❖ Create vertical separation between tree canopy and surface fuels below.
- ❖ Remove dead materials and reduce depth of duff
- ❖ Encourage and protect this vegetation type.

Treatments

Special Considerations

Although redwood forests are often thought of as fire resistant and adapted to natural fire cycles, it can be damaged by intense fires. Light fires are beneficial in this vegetation type, with many of the associated species having adaptive attributes. No special status plants are reported from this type in the study area. Periodic checks for nesting raptors should be conducted prior to active management in this type.

Potential Treatments and Limitations

- ✓ Hand Labor: Effective for removal of litter below trees, dead limbs and other treatment prior to treatment with prescribed fire. Effective for selective thinning of stands by removal of structurally hazardous trees or on sites with other special considerations. Haul routes planned for removal of cut trees must minimize adverse impacts.
- ✓ Grazing: Not recommended. In open stands, if goat grazing is utilized to clear understory materials, protection of trees and desirable species is required.
- ✓ Prescribed burn: Pile or stationary burns are effective for removal of dead limbs or other materials gathered by hand. Low intensity broadcast burns are effective for removal of litter build-up especially in open redwood stands. Sometimes requires use of other methods to prepare stand prior to safe use and to prevent crowning.
- ✓ Mechanical: Not recommended. May be used selectively to clear encroaching brush at margins of stands. Utilize on slopes under 30% to avoid adverse effects due to heavy equipment. Haul routes planned for removal of cut trees must minimize adverse impacts. Keep equipment at least 100 feet from the top of bank of intermittent or perennial streams.

Treatment Performance Standards

Avoid treatment in healthy stands with closed canopy and minimal understory shrubs that meet the standards of Fuel Model #8 Closed Timber Litter or Fuel Model #9 Hardwood Litter (High). In open stands use the following as a guide:

- ☐ Separation of fuel (structure)
 - X 8' vertical clearance between live needles and understory fuel. Remove all dead material.
 - X Prune branches up to 3" in diameter. Prune up a maximum of 1/3 height for trees that are not taller than 24' tall.

- ☐ Dead-fuel : under 20 tons/acre (t/a). Depth of duff no greater than 4 inches
- ☐ Stand density: Encourage closed canopy. Minimize understory competition.
- ☐ Conversion to lighter fuel types: Do not convert to lighter fuel types.
- ☐ Maximum removal of live materials: Maintain canopy closure.
- ☐ Species diversity: Maintain and encourage redwood trees.
- ☐ Grazing standards: Do not graze, except for margins of forest. Protection of individual specimens from browse and girdling.
- ☐ Debris load remaining (see appropriate treatment standards for grass or shrub understory)
 - ✗ Debris to remain in place: see brush.
 - a) Mulch or dispose off site all dead materials.
 - b) Cut logs greater than 4" diameter to firewood lengths.
 - ✗ Specifications for chippers / mulch standards
 - a) To feed into chipper: Maximum length 6'. Maximum diameter 4".
 - b) Maximum mulch depth: 5"

Riparian Forest

Usually a narrow zone along perennial creeks and drainage swales where the moisture level is higher year round. Dominated by mixture of deciduous & evergreen trees, shrubs and groundcovers. including: Bay Trees, Maples, Oaks, Redwoods, Willows, Ceanothus, Ferns, Honeysuckle, Oxalis, Wild rose. In general this vegetation type represents the lowest fire concern and can be beneficial.



Riparian Forests represent relatively low fire hazards in the Study Area.

Primary Fuel Characteristic:

Fire Behavior and Responsiveness to Suppression:

Overall hazard is rated as low with flame lengths ranging from 2 to 5 feet depending upon development stage and slope. Riparian forests were modeled as Hardwood litter (NFFL model #9) and Closed Timber litter (NFFL model #8).

Ignition Potential:

Ignition potential is low due to moisture levels with an index of 8.

Characteristics:

- ◆ Difficult to ignite
- ◆ Responds very slowly to changes in temperature and moisture.
- ◆ Natural structure may form protective canopy.
- ◆ Relatively low ratio of dead to live materials
- ◆ Often lacking well developed understory.

Desired Fire Hazard Reduction Results:

- ❖ Encourage dense, healthy canopy to shade out more flammable understory and exotic species. Minimize maintenance activities. Restrict activities to along edge.
- ❖ Remove dead materials and reduce build up of flammable duff.

- ❖ Create separation between surface fuels (especially from adjacent areas) and taller trees or other aerial fuels by reducing height of shrub layer, and pruning some to all of the smaller, lower branches.
- ❖ Encourage and protect this vegetation type.

Treatments

Special Considerations

Riparian forest is an important natural community valued for its productivity, critical habitat for a large variety of vertebrate species and its intrinsic value. Great care should be exercised to avoid adverse impacts to this vegetation type and any impacts to adjacent streams, wetlands or other water bodies.

Potential Treatments and Limitations

- ✓ Hand Labor: Effective for removal of litter below trees, exotic species and dead limbs to reduce excessive build-up of fuel in open canopy or previously disturbed riparian communities. Effective for selective thinning of stands by removal of structurally hazardous trees or sites with other special considerations. Haul routes planned for removal of cut trees must minimize adverse impacts.
- ✓ Grazing: - Not recommended. If goat grazing is utilized to clear understory materials, protection of trees and desirable species is required.
- ✓ Prescribed burn: Not recommended. Pile or stationary burns are effective for removal of dead limbs or other materials gathered by hand. Burn sites should be located at least 100 feet outside of riparian zone.
- ✓ Mechanical: Not recommended. May be used selectively to clear encroaching brush at margins of area. Utilize on slopes under 30% to avoid adverse effects due to heavy equipment. Haul routes planned for removal of cut trees must minimize adverse impacts. Keep equipment at least 100 feet from the top of bank of intermittent or perennial streams.
- ✓ Chemical: Avoid all use of chemical treatment in these areas.

Treatment Performance Standards

Avoid treatment in healthy stands with closed canopy and minimal understory shrubs that meet the standards of Fuel Model #8 Closed Timber Litter or Fuel Model #9 Hardwood Litter (High). In open or previously disturbed stands use the following as a guide:

- ☐ Separation of fuel (structure)
 - X 8' vertical clearance between live leaves and understory fuel. Remove all dead material.
 - X Prune branches up to 3" in diameter. Prune up a maximum of 1/3 height for trees that are not taller than 24' tall.
- ☐ Dead-fuel : under 10 tons/acre (t/a). Depth of ~~drift~~ no greater than 5 inches
- ☐ Stand density: Encourage closed canopy. Minimize understory.
- ☐ Conversion to lighter fuel types: Do not convert to lighter fuel types.
- ☐ Maximum removal of live materials: Maintain canopy closure.
- ☐ Species diversity: Maintain and encourage species diversity of trees.
- ☐ Grazing standards: Do not graze, except for margins of forest. Protection of individual specimens from browse and girdling.
- ☐ Debris load remaining (see appropriate treatment standards for grass or shrub understory)
 - X Debris to remain in place: see brush.
 - a) Mulch or dispose off site all dead materials.

Appendix E: REPORT PREPARATION

Report Preparation

The Leona Canyon Regional Open Space Preserve Land Use Plan was prepared under the management of **Pat O'Brien**, General Manager, **Thomas Mikkelsen**, Assistant General Manager, Planning/Stewardship, Design and Construction, and **Maxine Turner**, Chief, Planning/Stewardship.

Danica Snyder, Park Planner, led the Planning/Stewardship team. Report authors included **Danica**, **Joe DiDonato**, Wildlife Specialist, **Ray Budzinski**, Range Management Specialist, **Dan Sykes**, Park Planner, **Sue Ferrera**, Leona Canyon Park Supervisor, and **Matt Madison**, Captain. Staff support was provided by **Josephine Orozco**, Planning Technician, and **Linda Faria**, Secretary. The department received substantial ideas, information and support from many EBRPD staff members in the Operations, Land Acquisition, and Design Departments, and they are hereby gratefully acknowledged.

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